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Energy Research Abstracts

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Office of Scientific and Technical Information
UNITED STATES DEPARTMENT OF ENERGY

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UNITED STATES DEPARTMENT OF ENERGY
Office of Scientific and Technical Information
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Energy Research Abstracts

Coverage

Energy Research Abstracts (ERA) provides abstracting and indexing coverage of all scientific and technical reports and patent applications originated by the U.S. Department of Energy, its laboratories, energy centers, and contractors, as well as theses and conference papers and proceedings issued by these organizations in report form. Audiovisual materials, computer media (magnetic tapes, diskettes, etc.), and engineering drawings are included in this definition. *ERA* also covers other energy information prepared *in report form* by federal and state government organizations, foreign governments, and domestic and foreign universities and research organizations, *provided* that the full text of the document has been received by OSTI. Foreign report information is obtained through the International Energy Agency's 14-nation Energy Technology Data Exchange, the International Atomic Energy Agency's International Nuclear Information System, or nation-to-nation agreements. The purpose of this publication is to announce documents produced or obtained by DOE that are not so readily available as journal articles, books, or patents.

Scope

The scope of *ERA* encompasses DOE's research, development, demonstration, and technology programs resulting from its broad charter for energy sources, supplies, safety, environmental impacts, and regulation.

The citations presented in *ERA* are available for online searching as records within the Energy Science and Technology Database (EDB). The current-year records are available on the Integrated Technical Information System (ITIS).

Availability

DOE and DOE contractors who have OSTI deposit accounts can obtain *ERA* (regular issues and annual indexes) from the Office of Scientific and Technical Information, P.O. Box 62, Oak Ridge, TN 37831, Attention: Information Services. For further information, call (615)576-8401. *ERA* is also available at authorized GPO Depository Libraries. (List is provided on the inside back cover.)

ERA (regular issues and annual indexes) is available to the public on a subscription basis from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

Managing Editor, Doris M. Henline
Technical Editor, Milton O. Whitson

Information Sources

The citations presented in *Energy Research Abstracts* are a subset of the worldwide energy information provided to the Office of Scientific and Technical Information (OSTI) through exchange agreements with foreign sources and through exchanges or contracts with U.S. organizations.

The **Energy Technology Data Exchange (ETDE)** was established by the International Energy Agency to promote cooperation among members in conducting appropriate energy-related research and development programs through the development of a formal central information sharing system. In accomplishing the objectives of the ETDE, members select, abstract, and index relevant research information published in their countries in accordance with Exchange standards. OSTI serves as the central receiving and processing center for this information, which it then disseminates to national centers in the participating countries. The following countries are currently members of the ETDE:

- Canada
- Denmark
- Finland
- France
- Federal Republic of Germany
- Italy
- Japan
- The Netherlands
- Norway
- Spain
- Sweden
- Switzerland
- United Kingdom
- United States

The **International Nuclear Information System (INIS)** was established to promote the exchange of information on nuclear science and technology. Its operation is similar to that of the ETDE, with the INIS Secretariat being located in Vienna, Austria. Currently, 79 countries and 15 international organizations are members of INIS. OSTI serves as the INIS national center for the United States.

In the exercise of its rights and responsibilities under the agreements to which it is a party, the **Office of Scientific and Technical Information** both receives information from the above sources and submits U.S.-produced information to them. In addition to materials generated by the Department of Energy, this U.S.-produced information is gathered from other government agencies as well as under contract with private information processing companies. All input is computer processed and entered into a database for online retrieval. The database serves as well for the production of numerous OSTI publications.

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The principal data elements included in these citations are:

1. **Abstract number** within volume.
2. **Report number** identification for report-type literature.
3. **Title and subtitle** (non-English title may appear in parentheses, if applicable).
4. **Author(s).** First 10 names in the data record are printed, then "et al." is listed.
5. **Author affiliation.** Only first one is listed, in parentheses after author(s) to which it applies.
6. **Collaboration,** if present.
7. **Corporate author(s)** identifying corporation responsible for document.
8. **Date of publication.** If not known, a processing date is in brackets.
9. **Number of pages** or page range. Prices are based on total pages unless special pricing applies.
10. **Language** of document if non-English.
11. **Monograph title** if citation is an analytic (part, chapter, or paper) of a larger monograph.
12. **Sponsoring organization.**
13. **Contract or grant number.**
14. **Secondary identifying number;** may be a conference number.
15. **Conference title, location, and date,** if applicable.
16. **Order number.** The "DE" order number may be used for ordering from NTIS or OSTI, as appropriate. The "TI" prefix is valid only at OSTI.
17. **Sources of availability** from which a copy of the document may be obtained; usually appear as abbreviations. (See information on following page.)
18. **Drop note** or explanatory statement.
19. **Abstract.**
20. **Subject descriptors.** Listed only if no abstract or only a brief statement is included.

Sample Citations

Report

18494 (DOE/ER/40438–T1) **[Development of a hydrogen and deuterium polarized gas target for application in storage rings]: Progress report.** Haeberli, W. Phys. VI collaboration. Wisconsin Univ., Madison (USA). Dept. of Physics. [1989]. 12p. Sponsored by DOE Energy Research. DOE Contract FG02-88ER40438. Order Number DE89007246. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper briefly discusses the Wisconsin test facility for storage cells; results of target tests; the new UHV...

Report Analytic

18500 (INIS-SU—69, pp. 30-32) **Transition energies in Ne-like ions. Correlation effects.** Vainshtejn, L.A. AN SSSR, Moscow. Fizicheskij Inst. 1988. (In Russian). In *Experimental and theoretical physics. Collection.* Order Number DE89780060. Available from NTIS (US Sales Only), PC A03/MF A01; INIS.

Kratkie Soobshcheniya po Fizike.; no. 6.

SILVER IONS/energy-level transitions; XENON IONS/energy-level transitions; CORRELATIONS; D STATES; E STATES;...

54 (DOE/ER/60888-1-Vol.1, pp. 115-117) **Investigation of air pollution in house due to use of various fuels.** Luo, Dayu (Chengdu Sanitation (China)). Canada Mortgage and Housing Corp., Ottawa, ON (Canada). 1990. (CONF-900724-Vol.1: Indoor Air '90: 5th international conference on indoor air quality and climate, Toronto (Canada), 29 Jul - 3 aug 1990). In Indoor air '90: The fifth international conference on indoor air quality and climate. Volume 1: Final report. 786p. Order Number DE90017786. Source: NTIS.

Air pollution in houses caused by combustion of coal is more serious than that by combustion of natural gas and methane (primarily by SO_2 and NO_2). The gas concentration after cooking is higher than that before cooking, and it is higher in kitchen than in bedroom and outdoor. There were mutations in the extract from TSP in 30m^2 air in the bedroom, kitchen and outdoor, where coal and natural gas were used. The supernatant saliva activity of children whose family uses coal is significantly lower than that of pumping streams.

How To Order from the Availability Sources

TO OBTAIN A REPORT

Report literature, usually identified by an alphanumeric identifier at the beginning of a citation, is available from the sources listed in the citation (see example of element 2 on page iii). Often the sources are listed as abbreviations. Corresponding addresses are provided at right from which documents with these abbreviations may be ordered. When "OSTI" is given, **DOE and DOE contractors may order these documents from OSTI.** (However, check with your library or information organization which may require that orders go through them to OSTI.) OSTI prices are based on total pages unless special pricing applies. The public should order from NTIS or from one of the other agencies listed in the citation. NTIS price codes may continue to appear in some records. To expedite processing, an order form is provided in the back of this publication. NOTE: The order numbers provide quicker access for report ordering. Use the order number where possible.

GPO Superintendent of Documents
Government Printing Office
Washington, DC 20402

GPO Dep. Available for inspection or interlibrary loan at Government Printing Office regional depository libraries.

INIS *Available only in microfiche.*
INIS Clearinghouse
International Atomic Energy Agency
P.O. Box 100, A-1400
Vienna, Austria

NTIS U.S. Department of Commerce
National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161

OSTI U.S. Department of Energy
Office of Scientific and Technical Information
P.O. Box 62
Oak Ridge, TN 37831

ESTSC Energy Science and Technology
Software Center
P.O. Box 1020
Oak Ridge, TN 37831

How To Use the Indexes

Five indexes are provided for approaching the content of each issue of *Energy Research Abstracts*. Descriptions of entries in these indexes follow.

Corporate Author Index
The corporation, organization, or institution responsible for the issuance of the document is listed in this index. The entries are arranged alphabetically and provide the title and citation number of the reference. For example, the listing for the "Report" sample citation would appear as shown at right.

Wisconsin Univ., Madison (USA). Dept. of Physics
[Development of a hydrogen and deuterium polarized gas target for application in storage rings]: Progress report, 15:18494 (R;US)
Wisconsin Univ., Madison (USA). Lab. of Genetics
Organization of the R chromosome region in maize: Final progress report, June 1, 1983–May 31, 1986, 15:18255 (R;US)

Personal Author Index
Each author's name listed on a document cited in this issue is indexed. An index entry provides title and citation number; for secondary and other names, a cross-reference is given to the primary author name where the full index entry is located.

Hadley, D.L., *See* Lee, A.D., 15:17651
Haeberli, W., [Development of a hydrogen and deuterium polarized gas target for application in storage rings]: Progress report, 15:18494 (R;US)

Subject Index
This index lists the main subject descriptors assigned to each record by indexing professionals. A secondary or qualifier term is used where necessary to describe materials, objects, and processes. Document titles may be enhanced with additional informative phrases where necessary. An excerpt from this index appears at right.

HYDROGEN ISOTOPES
See also DEUTERIUM
HYDROGEN 4
TRITIUM
Neutron-Rich Isotopes
Study on the strong neutron-rich nuclei of lightest elements, 15:18686 (RA;SU;In Russian)

Contract Number Index
DOE technical reports are listed by contract number. Each entry also provides the primary corporation or organization cited for that contract number. A typical entry is shown.

FG02-88ER40438 **Wisconsin Univ., Madison (USA). Dept. of Physics**
15:18494 DOE/ER/40438–T1
FG02-88ER60664 **Rogers and Associates Engineering Corp., Salt Lake City, UT (USA)**

Report Number Index
Technical report literature is indexed by the alphanumerical identifier of the report. Patent documents and conferences are included for convenience. Each entry lists the citation number, the source of availability of the document, an indicator of presence at a GPO depository library, order number, and distribution category. A typical entry is:

DOE/ER/40438–
T1 15:18494 NTIS, OSTI E 1.99: DE89007246 MF-411

Subject Contents

The subject content of *Energy Research Abstracts* is arranged as shown below. The two-digit and four-digit category numbers printed here illustrate the category number assignment used in the database records.* The following list includes all of the 38 first-level and the 313 second-level categories. Because each issue of *ERA* publishes citations only for those documents announced during the past semimonthly period, some subject categories may not be present in every issue.

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*The numerical subject category scheme is used in the storage, retrieval, and manipulation of bibliographic information entered into DOE's data systems. Categories and definitions for the complete set of six-digit numbers are given in ETDE/PUB--1-R2, *International Energy: Subject Categories and Scope*.

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Energy Research Abstracts

01 COAL, LIGNITE, AND PEAT

0103 Preparation

Refer also to citation(s) 31, 37, 46, 67, 70, 79

1 (CONF-920736–) **Eighth annual coal preparation, utilization, and environmental control contractors conference: Proceedings.** USDOE Pittsburgh Energy Technology Center, PA (United States). [1992]. 682p. Sponsored by USDOE, Washington, DC (United States). From 8. coal preparation, utilization, and environmental control conference; Pittsburgh, PA (United States); 26-31 Jul 1992. Order Number DE92041184. Source: OSTI; NTIS; GPO Dep.

The Eighth Annual Coal Preparation, utilization, and Environmental Control Contractors Conference was held at Pittsburgh, Pa., July 27–30, 1992. Approximately 106 individual papers were given. Individual papers have been entered separately. (LTN)

2 (DOE/PC/79892–T21) **Development of the chemical and electrochemical coal cleaning (CECC) process: Final report.** Yoon, Roe-Hoan; Basilio, C.I. Virginia Center for Coal and Minerals Processing, Blacksburg, VA (United States). May 1992. 206p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-87PC79892. Order Number DE93000478. Source: OSTI; NTIS; GPO Dep.

The Chemical and Electrochemical Coal Cleaning (CECC) process developed at Virginia Polytechnic Institute and State University was studied further in this project. This process offers a new method of physically cleaning both low- and high-rank coals without requiring fine grinding. The CECC process is based on liberating mineral matter from coal by osmotic pressure. The majority of the work was conducted on Middle Wyodak, Pittsburgh No. 8 and Elkhorn No. 3 coals. The coal samples were characterized for a variety of physical and chemical properties. Parametric studies were then conducted to identify the important operating parameters and to establish the optimum conditions. In addition, fundamental mechanisms of the process were studied, including mineral matter liberation, kinetics of mineral matter and pyrite dissolution, ferric ion regeneration schemes and alternative methods of separating the cleaned coal from the liberated mineral matter. The information gathered from the parametric and fundamental studies was used in the design, construction and testing of a bench-scale continuous CECC unit. Using this unit, the ash content of a Middle Wyodak coal was reduced from 6.96 to 1.61% at a 2 lbs/hr throughput. With an Elkhorn No. 3 sample, the ash content was reduced from 9.43 to 1.8%, while the sulfur content was reduced from 1.57 to 0.9%. The mass balance and liberation studies showed that liberation played a more dominant role than the chemical dissolution in removing mineral matter and inorganic sulfur from the different bituminous coals tested. However, the opposite was found to be the case for the Wyodak coal since this coal contained a significant amount of acid-soluble minerals.

3 (DOE/PC/89766–T8) **Pelletization of fine coals: Technical progress report, March 1, 1992–May 31, 1992.** Sastry, K.V.S. California Univ., Berkeley, CA (United States). Dept. of Materials Science and Mineral Engineering. [1992]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-89PC89766. Order Number DE92040533. Source: OSTI; NTIS; GPO Dep.

The first step consisted of producing a batch of seed pellets (in the size range −4.75+4.00 mm) by pelletizing of 200 g of ground coal with desired additives (surface active agents and binders) and moisture content for 800 revolutions. The seed pellets are obtained by sieving the output from the batch drum. The second step involved the production of finished size pellets by layering the seed pellets with stepwise addition of moist feed which is again produced with desired additives and moisture content. Specifically, 25 g of the −4.75+4.00 mm seed pellets are placed in the drum and 20 g of moist fluffy feed is added every 80 revolutions for five times. After 400 revolutions the pellets are sieved on the 4.75 mm screen and the screen undersize which corresponds to new seeds generated during the layering cycles is discarded. Now, 30 g of moist fluffy feed is added every 50 revolutions for five more cycles. These layered pellets are sieved again and the −9.5+8.00 mm pellets. Coal agglomerates produced by the above described technique are nice and spherical. With our past experience with iron ore pelletization we learnt that as long as sufficient fluffy feed is available for the consumption by the seed pellets, they generally grow by forming layers consuming the feed rather than grow by coalescence. This is found to be true in the case of coal also. Growth by coalescence of coal pellets is found to yield raspberry type uneven agglomerates. After ascertaining the possibility of producing nice spherical pellets, several experiments have been conducted to develop the above standard procedure for making pellets in a reproducible way and testing them for their quality.

4 (DOE/PC/90174–T5) **Development of the selective coagulation process: Final report.** Yoon, R.H.; Luttrell, G.H. Virginia Center for Coal and Minerals Processing, Blacksburg, VA (United States). Jul 1992. 235p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-90PC90174. Order Number DE93000484. Source: OSTI; NTIS; GPO Dep.

The selective hydrophobic coagulation (SHC) process is based on the recent finding that hydrophobic particles can be selectively coagulated without using traditional agglomerating agents or flocculants. The driving force for the coagulation is the attractive energy between hydrophobic surfaces, an interaction that has been overlooked in classical colloid chemistry. In most cases, selective separations can be achieved using simple pH control to disperse the mineral matter, followed by recovery of the coal coagula using techniques that take advantage of the size enlargement. In the present work, studies have been carried out to further investigate the fundamental mechanisms of the SHC process and the parameters that affect the process of separating coal from the ash-forming minerals and pyritic sulfur. Studies have included direct force measurements of the attractive interaction between model hydrophobic surfaces, in-situ measurements of the size distributions of coagula formed under a variety of operating conditions, and development of a population balance model to describe the coagulation process. An extended DLVO colloid stability model which includes a hydrophobic interaction energy term has also been developed to explain the findings obtained from the experimental studies. In addition to the fundamental studies, bench-scale process development test work has been performed to establish the best possible method of separating the coagula from dispersed mineral matter. Two types of separators, i.e., a sedimentation tank and a rotating drum screen, were examined in this study. The sedimentation tank proved to be the more efficient unit, achieving ash reductions as high as 60% in a single pass while recovering more than 90% of the combustible material. This device, which minimizes turbulence and coagula breakage, was used in subsequent test work to optimize design and operating parameters.

5 (DOE/PC/91283–T2) **Liquid chromatographic analysis of coal surface properties: Quarterly progress report, September–December 1991.** Kwon, K.C. Tuskegee Univ., AL (United States). Dept. of Chemical Engineering. [1991]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-91PC91283. Order Number DE92040537. Source: OSTI; NTIS; GPO Dep.

The main objectives of this proposed research are to refine further the inverse liquid chromatography technique for the study of surface properties of raw coals, treated coals and coal minerals in water, to evaluate relatively surface properties of raw coals, treated coals and coal minerals by inverse liquid chromatography, and to

evaluate floatability of various treated coals in conjunction with surface properties of coals. Alcohols such as methanol, ethanol, isopropanol, isobutanol, tert-butanol, heptanol, 1-hexadecanol, 2-methyl-pentanol, 4-methyl-2-penthanol (methylisobutyl carbinol), n-octanol, s-octanol, and cyclohexanol as probe compounds are utilized to evaluate hydrophilicity of coals and coal minerals. N-alkanes such as hexane, heptane and octane, and stearic acid are employed as probe compounds to evaluate hydrophobicity of coals and coal minerals. Aromatic compounds such as benzene and toluene as probe compounds are used to examine aromaticity of coal surface. Aromatic acids such as o-cresol, m-cresol, p-cresol, phenol and B-naphthol are used to detect aromatic acidic sites of coal surface. Hydrophilicity, hydrophobicity and aromaticity of surfaces for either raw coals or treated coals in water are relatively determined by evaluating both equilibrium physical/chemical adsorption and dynamic adsorption of probe compounds on various raw coals and treated coals to compare affinities of coals for water.

6 (DOE/PC/91290–T3) **Non-intrusive measurement of particle charge: Electrostatic dry coal cleaning: Technical progress report No. 4, April 1, 1992–June 30, 1992.** Schaefer, J.L.; Stencel, J.M.; Ban, H. Kentucky Univ., Lexington, KY (United States). Center for Applied Energy Research. [1992]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-91PC91290. Order Number DE93000736. Source: OSTI; NTIS; GPO Dep.

A test apparatus utilizing a Phase Doppler Particle Analyzer was developed to non-intrusively determine charge on small particles. Optimum operating conditions for the system were determined using highly characterized silica spheres with an average particle diameter of 60μ in a dry N_2 gas. The silica spheres were triboelectrically charged, and passed through a high intensity electric field. The charged particle trajectories, diameter, and number density were monitored using a two component laser PDPA. From this data and known operating parameters charge magnitude was determined.

7 (DOE/PC/91334–T69) **Dewatering studies of fine clean coal: Technical report, March 1, 1992–May 31, 1992.** Parekh, B.K. (Kentucky Univ., Lexington, KY (United States). Center for Applied Energy Research). Illinois State Geological Survey, Champaign, IL (United States). [1992]. 22p. Sponsored by USDOE, Washington, DC (United States); Illinois Dept. of Energy and Natural Resources, Springfield, IL (United States). DOE Contract FG22-91PC91334. Order Number DE93000519. Source: OSTI; NTIS; GPO Dep.

Physical cleaning of ultra-fine coal using an advanced froth flotation technique provides a low ash product, however, due to high surface area of particles the amount of water associated with clean coal is high. Economic removal of water to 20 percent or lower moisture level from the clean coal froth will be important for commercial applicability of advanced froth flotation processes. The main objective of the present research program is to study and understand the dewatering characteristics of ultra-fine clean coal and to develop process parameters to effectively reduce the moisture to less than 20 percent in the clean coal product. The research approach under investigation utilizes synergistic effect of metal ions and surfactant to lower the moisture of clean coal using a conventional vacuum dewatering technique. The studies have identified a combination of metal ions and surfactant found to be effective in providing a 22 percent moisture filter cake. During the third quarter, efforts were made to understand reagent adsorption mechanism. Adsorption studies indicated that the presence of metal ions enhanced adsorption of surfactant. It appears that metal ions induced floc formation at pH ~7.0, which are hydrophilic in nature, however addition of surfactant restores the hydrophobicity. Organic polymers along with metal ions were found to be effective in dewatering of fine coal. Continuous filtration tests conducted using a drum filter provided a filter cake containing 24 percent moisture. Additional studies on mechanism of adsorption and continuous filtration using AC Electro-Coagulation will be conducted in the next quarter.

8 (DOE/PC/91334–T73) **Thermal treatment for chlorine removal from coal: [Quarterly] technical report, March 1, 1992–May 31, 1992.** Muchmore, C.B.; Hesketh, H.E.; Chen, Han Lin. Southern Illinois Univ., Carbondale, IL (United States). [1992]. 24p. Sponsored by USDOE, Washington, DC (United States); Illinois Dept. of Energy and Natural Resources, Springfield, IL (United States). DOE Contract FG22-91PC91334. Order Number DE93000522. Source: OSTI; NTIS; GPO Dep.

It is the goal of this research to provide the technical basis for development of a process to remove chlorine from coal prior to combustion, based on a thermal treatment process. Under the reaction conditions employed, the behavior of other trace elements of concern will also be evaluated. The recovery of the chlorine removed from the coal as a marketable byproduct, calcium chloride suitable for use as a road deicer, is also being investigated using a novel absorption/crystallization device. A value of 6.29 hr^{-1} was determined for the dechlorination rate constant of IBC-109 coal at 385°C, and an activation energy of 34.7 kcal/mol was obtained from an Arrhenius plot over the temperature range of 300–385°C. A significant removal of chlorine (84.3%) was attained while retaining 92% of the energy of the coal in the solid product by preheating the coal at lower temperatures prior to a six-minute reaction at 385°C. Volatiles lost during the thermal dechlorination may be recovered for their heating value, and/or as a source of chemical feedstocks; this aspect will require further study, but it appears that the overall energy balance on the system should prove to be favorable. The design of the bench scale fluidized bed thermal dechlorination unit has been completed, and components ordered. Operation of this system should provide the information required for further scale-up of the process.

9 (DOE/PC/91334–T84) **A novel technique for evaluating cleaned fine and ultrafine coal: [Quarterly] technical report, 1 March 1992–31 May 1992.** Crelling, J.C.; Hippo, E.J. Southern Illinois Univ., Carbondale, IL (United States). [1992]. 23p. Sponsored by USDOE, Washington, DC (United States); Illinois Dept. of Energy and Natural Resources, Springfield, IL (United States). DOE Contract FG22-91PC91334. Order Number DE93000533. Source: OSTI; NTIS; GPO Dep.

As a standard industrial practice all commercially cleaned coals are evaluated by washability analysis to predict their cleaning potential. The results of this analysis are so important that coal washability is a major factor in deciding to purchase and develop coal holdings. However, washability analysis are at present limited to coal particle sizes of greater than -28 mesh (0–6 mm)- Coal particles smaller than this limit 0 separate well in the standard sink-float process used in the washability tests. The increasing demand for cleaner coals requires that coals be crushed to fine (-100 mesh - 0.15 mm) and ultrafine (-325 mesh- 0.045 mm) sizes to liberate more of the fine-grained mineral matter including pyrite. However, such small coal particles can not be analyzed in the standard washability analysis. The purpose of this study is to develop a washability analysis system for fine and ultrafine coal particles using Density Gradient Centrifugation (DGC) and Thermal Gravimetric Analysis (TGA) techniques. The unique advantages of this proposed technique is that it provides a means to obtain usable washability curves on fine and ultrafine coal samples. The DGC technique will produce a large number of density fractions in a single run and, thus, is much faster and more efficient that normal washability analysis. The results to date indicate that only a single DGC run is needed to produce all twelve density fractions for a washability analysis. The recoveries of the fractions are sufficient for sulfur and ash analysis and washability analyses have been successfully completed using the DGC technique. For the Herrin No. 6 sample (IBCSP 101-SIU 2181) there appears to be little difference in recovery for the four size fractions, however, the smaller size fractions do have slightly more liberated ash and pyrite.

10 (VTT-SYMP–134) **Artificial dewatering of peat.** Alakangas, E. (ed.). Technical Research Centre of Finland, Espoo (Finland). 1992. 149p. (CONF-9110428–: Conference on artificial dewatering of peat, Jyvaeskylae (Finland), 15-16 Oct 1991). Order Number DE93721607. Source: OSTI; NTIS.

This publication presents in edited form the proceedings of the research seminar held in Jyvaeskylae on 15-l6th October 1991. The seminar was a part of Nordic cooperation in the research area of artificial dewatering of peat. There are research programmes on artificial dewatering of peat both in Finland and in Sweden. These programmes aim to develop economical peat production methods

which are not dependent on weather or the season. This proceeding consists of papers of mining and transportation of peat, dewatering of peat and utilization technology for wet peat.

11 (VTT-SYMP–134, pp. 17-26) **Peat-digging all-year-round.** Vestman, E. (Haegglunds Component Ab, Mellansel (Sweden). Division Mining and Tunneling Machinery). Technical Research Centre of Finland, Espoo (Finland). 1992. (CONF-9110428–: Conference on artificial dewatering of peat, Jyvaeskylae (Finland), 15-16 Oct 1991). In *Artificial dewatering of peat.* 149p. Order Number DE93721607. Source: OSTI; NTIS.

In the spring 1984 ABB STAL, Haegglunds and the Swedish State Power Board began to plan a common development project in the field of peat. The purpose was to develop a system for production of dry peat fuel all the year round. A part of the system was to be the peat-digging equipment from Haegglund. Between the autumn of 1984 until the summer of 1985 the first stage of the project was carried out. During this time Haegglunds developed a system for deep excavating of peat all the year round while the Swedish State Power Board tested press-systems for the mechanical dewatering of the peat. At ABB STAL the development work on the fluidized bed-dryer continued. The result of this work was so positive that it was decided to continue the project and build a pilot plant. A fullscale plant was to be built later.

12 (VTT-SYMP–134, pp. 27-34) **Efficiency and environmental effects of peat dewatering by mechanical pressing.** Aho, M. (Technical Research Centre of Finland, Jyvaeskylae (Finland). Combustion and Thermal Engineering Lab.); Pirkonen, P. Technical Research Centre of Finland, Espoo (Finland). 1992. (CONF-9110428–: Conference on artificial dewatering of peat, Jyvaeskylae (Finland), 15-16 Oct 1991). In *Artificial dewatering of peat.* 149p. Order Number DE93721607. Source: OSTI; NTIS.

Changes in the structures of three types of Finnish peats (C, B and S) and the emissions into pressing water were studied during mechanical pressing. Pressing was done at pH 3.2 by using the Fennopol A 3006 (weakly anionic polyacrylamide-type) chemical. This combination has previously been found to be the most inexpensive and effective combination for peat pressing. The dry solid load was 2.4 kg/m2. Clear differences were obtained in the water binding capacities of the peats studied. The dry solid contents of the peats after the pressing time of 500 seconds in 2.0 MPa by a computer controlled piston press of two-way water outlet were as follows: C-peat 37.0 %, B-peat 33.5 % and S-peat 27.5 %. A large amount of the chemical was bound to peat during flocculation. 20-40 % of calcium and magnesium were released from the peat due to lowered pH, and > 80 % of iron and aluminum remained in the peat. Most of the sulfur of the sulfuric acid used for lowering of pH was found in the pressing water. Neutralizing the pressing water by calcium hydroxide to pH 7 costs about 8 USD per 1000 m3. The chemical costs of pressing are about 5 USD/t of dried peat.

13 (VTT-SYMP–134, pp. 35-51) **Some fundamental aspects of the dewatering of peat.** Theliander, H. (Chalmers University of Technology, Goethenburg (Sweden). Dept. of Chemical Engineering Design); Andersson, H.K.; Gren, U.; Muenter, M. Technical Research Centre of Finland, Espoo (Finland). 1992. (CONF-9110428–: Conference on artificial dewatering of peat, Jyvaeskylae (Finland), 15-16 Oct 1991). In *Artificial dewatering of peat.* 149p. Order Number DE93721607. Source: OSTI; NTIS.

Before peat from a bog can be used as a fuel most of the water must be separated. The major of the separation work is done by means of mechanical dewatering (filtration and expression). However, there are many problems related to mechanical dewatering of peat. To get a better understanding of dewatering of peat it is important to find models which describes the filtration and expression course. This paper presents some basic concepts to describe the filtration and expression properties of peat. It has been shown that the specific surface area and the specific filtration resistance increases with the humification degree of the peat. Furthermore, the compressibility constant decreases with the humification degree. It is therefore most likely that the filtration properties can be used as a measure to characterize peat. In order to describe the expression course three different models have been investigated. It was shown that of these models the so called Shirato model was the most reliable.

14 (VTT-SYMP–134, pp. 52-69) **Mechanical peat dewatering in the ultrapresse unit.** Henfridsson, U. (Vattenfall Utveckling AB, Aelvkarleby (Sweden). Research and Development, Technical Services). Technical Research Centre of Finland, Espoo (Finland). 1992. (CONF-9110428–: Conference on artificial dewatering of peat, Jyvaeskylae (Finland), 15-16 Oct 1991). In *Artificial dewatering of peat.* 149p. Order Number DE93721607. Source: OSTI; NTIS.

Vattenfall Utveckling AB, Research and Development, Technical Services is managing peat research in a number of different projects. The objective of this vork is to develop year around processes for productions of high quality fuel. In a peat production system that is weather independent a successful mechanical dewatering step is needed. Since dewatering is the key process in a peat production system, this work has so far been concentrated on tests of dewatering equipments in laboratory and pilote scale. The goal that has been stipulated in our work is to reach about 35 - 40 % DS-content in the mechanical dewatering step at an acceptable pressing capacity (14). The capacity goals for the pressing equipment must be related to the costs rather than to the specific capacity of the different presses. The capacity will therefore be judged in proportion to the investment.

15 (VTT-SYMP–134, pp. 70-84) **Results of dewatering research in Rittenshaus and Blecher chamber filter.** Wilde, J. (Vattenfall Utveckling AB, Aelvkarleby (Sweden). Research and Development, Technical Services). Technical Research Centre of Finland, Espoo (Finland). 1992. (CONF-9110428–: Conference on artificial dewatering of peat, Jyvaeskylae (Finland), 15-16 Oct 1991). In *Artificial dewatering of peat.* 149p. Order Number DE93721607. Source: OSTI; NTIS.

Vattenfall Utveckling AB have since 1985 been working with studies of weather independent production systems for peat fuel. The main problem in weather independent systems is to make the mechanical dewatering efficient enough to remove the main part of the water in the raw peat. To be able to produce a dry fuel and keep the thermal drying stage at a low cost the mechanical dewatering must be able to dewater the peat to more than 30 % dry solid content. The work at the laboratory has been focused on testing of dewatering equipment in a pilot scale. The goal for the tests has been to find a dewatering system that could dewater raw peat to more than 30 % dry solid content at a high capacity. The object of the project is to present a weather independent system that can produce peat fuel to a cost competitive to other fuels. One of the press systems that has been successful is dewatering of peat slurry with flocculants added in a high pressure chamber filter. The filter is manufactured by Rittershaus and Blecher GmbH Germany.

16 (VTT-SYMP–134, pp. 85-100) **Evaluation of the Adewa process.** Pirkonen, P. (Technical Research Centre of Finland, Jyvaeskylae (Finland). Combustion and Thermal Engineering Lab.). Technical Research Centre of Finland, Espoo (Finland). 1992. (CONF-9110428–: Conference on artificial dewatering of peat, Jyvaeskylae (Finland), 15-16 Oct 1991). In *Artificial dewatering of peat.* 149p. Order Number DE93721607. Source: OSTI; NTIS.

The main goal of the Adewa-research programme is to create a peat production method based on artificial dewatering. The most important subgoal is to obtain a dry solid content of 35 % in the mechanical dewatering phase with the economically viable capacity. The most interesting process alternative to produce peat for a power plant of 150 MW electricity is so called SLURRY-COMP-method which is based on slurry pumping and mechanical dewatering. The economical evaluation presented in this paper is focused on this method.

17 (VTT-SYMP–134, pp. 9-16) **Pumping properties of peat slurry.** Luukkainen, V.M. (Technical Research Centre of Finland, Espoo (Finland)). Technical Research Centre of Finland, Espoo (Finland). 1992. (CONF-9110428–: Conference on artificial dewatering of peat, Jyvaeskylae (Finland), 15-16 Oct 1991). In *Artificial dewatering of peat.* 149p. Order Number DE93721607. Source: OSTI; NTIS.

In the Adewa research programme a new peat production method, called SLURRY-COMP, has been found to be the most

viable way to produce peat for the artificial dewatering process. According to the process concept, peat, after being slurried to a DS-content of about 7 %, is pumped from the slurrying basin into a large storage pond situated near the power plant, and after that to the mechanical dewatering process. The aim of the studies carried out at Technical Research Centre of Finland is to obtain enough reliable information for the optimization of long distance pumping of peat slurry. Pumping tests with peat slurries have been carried out on the bog as well as under laboratory conditions. The DS-contents of the slurries have been 4 - 7 % on the bog and 5 - 9 % in the laboratory. According to the pressure losses measured in pipes of different sizes (inner diameters being 140 - 400 mm), the optimal DS-content of the slurry would be about 6 - 7 % with the medium humified Sphagnum peat. The viscosities of slurries made from the most common peats in Northern Finland, i.e. Carex peat, are smaller than those of the slurries made from Sphagnum peat, and, thus, the optimal DS-content with Carex peat may rise as high as to 7 - 8 %. In addition to peat type, also mining and slurrying technique (determining the particle size), pipe diameter, and flow velocity have a great influence on the flowing properties and pressure losses of peat slurry.

18 (VTT-SYMP–134, pp. 116-127) **New process alternatives for utilisation of wet peat.** Aeijaelae, M. (Imatran Voima Oy, Vantaa (Finland). R and D Center); Hulkkonen, S.; Raiko, M. Technical Research Centre of Finland, Espoo (Finland). 1992. (CONF-9110428–: Conference on artificial dewatering of peat, Jyvaeskylae (Finland), 15-16 Oct 1991). In *Artificial dewatering of peat.* 149p. Order Number DE93721607. Source: OSTI; NTIS.

To improve the economy of power generation with wet fuels, IVO has initiated the development of an advanced gas turbine power plant process for wet fuels as peat and biomass. The process consists of a steam injected gas turbine, an air-blown gasifier and a pressurized fuel dryer. The dryer operates in steam atmosphere and is integrated to the process to produce injection steam for the gas turbine. The heat needed for drying is taken from the exhaust gases of the gas turbine. This process is patented and called IVO-SDIG. By utilising integrated fuel drying, air gasification and a gas turbine-based process, a very high power generating efficiency is obtained. This enables a process efficiency of more than 50 % (calculated based on the lower heating value of the fuel). Other advantages provided by the IVO-STIG process are its simplicity low investment costs for small-size plants (20 - 100 MW_e) and capability of using wet low-grade fuels (moisture content up to 70 - 75 %) The economic calculations made by Imatran Voima Oy show that the cost of electricity of the IVO-SDIG process is lower than that with conventional processes.

19 (VTT-SYMP–134, pp. 128-138) **New power plant connected to Adewa process.** Flyktman, M. (Technical Research Centre of Finland, Jyvaeskylae (Finland). Combustion and Thermal Engineering Lab.). Technical Research Centre of Finland, Espoo (Finland). 1992. (CONF-9110428–: Conference on artificial dewatering of peat, Jyvaeskylae (Finland), 15-16 Oct 1991). In *Artificial dewatering of peat.* 149p. Order Number DE93721607. Source: OSTI; NTIS.

A combination of a gas turbine cycle and steam turbine cycle in has been the key to higher power plant efficiency. Applications based on pressurized fluidized bed combustion (PFBC), including its different modifications, or pressurized gasification (IGCC), also including several modifications, have been developed. The first of these applications are being commercialized. The newest applications are being developed on basis of pressurized pulverized fuel combustion (PPFC). This technique yields possibilities for high efficiency in producing electricity. Commercialization is expected to start by the late 1990's. The present status of the research and development of PPFC- combustion is discussed. The possible concepts for the application in Finnish electricity production is given. Peat produced by ADEWA process can be used as a fuel in PPFC-power plant.

20 (VTT-SYMP–134, pp. 139-145) **Experience of the peat briquette production at Haerjedalens Mineral Ab in Sveg.** Nordstroem, H. (Uppsala Energi Ab, Uppsala (Sweden)). Technical Research Centre of Finland, Espoo (Finland). 1992. (CONF-9110428–: Conference on artificial dewatering of peat, Jyvaeskylae (Finland), 15-16 Oct 1991). In *Artificial dewatering of peat.* 149p. Order Number DE93721607. Source: OSTI; NTIS.

The peat briquette production at Haerjedalens Mineral Ab in Sveg has now reached a level corresponding to the dimensioning data for the plant. During especially 1989 we had to evaluate and reconstruct some vital functions of the process and there are still solutions that must be better. However, until now, October 1991, ca 400 000 tons of briquettes have been produced. The costs are a bit higher than we calculated but the production is definitely going the right way and today peat is the best alternative for Uppsala Energi Ab compared to for example fossile fuels.

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Refer also to citation(s) 62, 69, 81, 826, 1041

21 (CONF-920815–9) **Hydrous pyrolysis of four Argonne Premium coals.** Serio, M.A.; Kroo, E.; Charpenay, S.; Solomon, P.R. Advanced Fuel Research, Inc., East Hartford, CT (United States). [1992]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-89PC89878. From 204. American Chemical Society national meeting; Washington, DC (United States); 23-28 Aug 1992. Order Number DE93000704. Source: OSTI; NTIS; GPO Dep.

Pretreatment experiments were done under hydrous pyrolysis conditions with four Argonne Premium coals (Zap lignite, Wyodak subbituminous, Illinois bituminous, Pittsburgh bituminous) over a range of temperatures (250–350°C) and pressures (1000 - 4000 psig). The residues from these experiments were further studied by programmed pyrolysis in a TG-FTIR system. The yields of pyrolysis tar were found to increase sharply at short pretreatment times (< 60 min at 350°C) and decline slowly at longer times. The yields of pyrolysis methane increase monotonically with pretreatment time, while the yields of pyrolysis CO_2 decline monotonically. All of these trends are in agreement with the contention that hydrous pyrolysis is similar to an accelerated geological aging of the coal. The results for CO evolution were somewhat contrary in that there was usually an initial increase followed by a decline. It is believed that this CO results from decomposition of hydroxy and dihydroxy structures which are created by the hydrous pyrolysis process.

22 (DOE/MC/24207–2994) **High-temperature pyrolysis mechanisms of coal model compounds: 1990 annual report.** Penn, J.H.; Owens, W.H. West Virginia Univ., Morgantown, WV (United States). Dept. of Chemistry. Jan 1991. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC21-87MC24207. Order Number DE91002075. Source: OSTI; NTIS; GPO Dep.

The degradation of the carboxylic acid group has been examined with respect to potential pretreatment strategies for fossil fuel conversion processes. In one potential pretreatment strategy involving cation exchange of the carboxylic acid group, a series of benzoic acid and stearic acid salts have been chosen to model the "tight" carboxylic acids of immature fossil fuel feedstocks and have been pyrolyzed with an entrained flow reactor. Our preliminary results indicate that Group I and II salts yield primarily the parent acid. Benzoate salts also yield small amounts of benzene while the stearic acid salts give no other detectable products. In two alternative treatment strategies, esterification and anhydride preparation have also been accomplished with these compounds being subjected to the entrained flow reactor conditions. The benzoate esters give a number of products, such as benzaldehyde, benzene, and low MW gases. The formation of these compounds is extremely dependent on pyrolysis conditions and alkoxy chain length. A xenon flashlamp and an entrained flow reactor have been used to heat organic substrates to varying temperatures using different heating rates. Ultrarapid flashlamp pyrolysis (heating rate $>10^{50}$C/s) has been performed. Since the ultrarapid pyrolysis products differ from those observed with traditional heating techniques and differ from the products formed photochemically, the flashlamp pyrolysis products are attributed to high temperature thermal activation.

23 (DOE/MC/25020–3129) **Upgrading of raw oil into advanced fuel: Task 5.** Lummus Crest, Inc., Bloomfield, NJ (United States). Oct 1991. 52p. Sponsored by USDOE, Washington, DC

(United States). DOE Contract AC21-88MC25020. Order Number DE93000214. Source: OSTI; NTIS; GPO Dep.

The overall objective of the research effort is the determination of the minimum processing requirements to produce high energy density fuels (HEDF) having acceptable fuel specifications. The program encompasses assessing current technology capability; selecting acceptable processing and refining schemes; and generating samples of advanced test fuels. The Phase I Baseline Program is intended to explore the processing alternatives for producing advanced HEDF from two raw synfuel feedstocks, one from Mild Coal Gasification as exemplified by the COALITE process and one from Colorado shale oil. Eight key tasks have been identified as follows: (1) Planning and Environmental Permitting; (2) Transporting and Storage of Raw Fuel Sources and Products; (3) Screening of Processing and Upgrading Schemes; (4) Proposed Upgrading Schemes for Advanced Fuel; (5) Upgrading of Raw Oil into Advanced Fuel (6) Packaging and Shipment of Advanced Fuels; (7) Updated Technical and Economic Assessment; and, (8) Final Report of Phase I Efforts. This topical report summarizes the operations and results of the Phase I Task 5 sample preparation program. The specific objectives of Task 5 were to: Perform laboratory characterization tests on the raw COALITE feed, the intermediate liquids to the required hydroprocessing units and final advanced fuels and byproducts; and produce a minimum of 25-gal of Category I test fuel for evaluation by DOE and its contractors.

24 (DOE/MC/26233–2935) **Advanced development of the Nested Fiber Filter: Phase 1, Evaluation of cleaning methods: Final report.** Litt, R.D.; Conkle, H.N.; Glover, R.C.; Jordan, H. Battelle, Columbus, OH (United States). Aug 1990. 40p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC21-89MC26233. Order Number DE91002019. Source: OSTI; NTIS; GPO Dep.

Battelle has completed Phase I of the DOE program to evaluate cleaning methods for the Nested Fiber Filter (NFF). The results of the investigations into fly ash bonding mechanisms, and mechanical vibration and acoustic vibration techniques led to the conclusion that acoustic cleaning with a pulse combustor is the preferred integrated system for high-temperature, high-pressure applications.

25 (DOE/MC/26366–2979) **A calcium oxide sorbent process for bulk separation of carbon dioxide: Annual report, September 1989–August 1990.** Harrison, D.P. Louisiana State Univ., Baton Rouge, LA (United States). Dept. of Chemical Engineering. Sep 1990. 100p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC21-89MC26366. Order Number DE91002059. Source: OSTI; NTIS; GPO Dep.

This research effort is designed to investigate the technical feasibility of a high-temperature, high-pressure process for the bulk separation of CO_2 from coal-derived gases. The two-year contract was awarded in September 1989. This report describes the research effort and results obtained during the first year of the effort. The overall project consists of 6 tasks, four of which were active during year 01. Tasks 1 and 2 were completed during the year while activity in Tasks 3 and 6 will carry over into year 02. Tasks 4 and 5 will be initiated during year 02. Three primary objectives were met in Task 1. A literature search on the calcination-carbonation reactions of CO_2 with calcium-based sorbents was completed. A high temperature, high pressure (HTHP) electrobalance reactor suitable for studying the calcination and carbonation reactions was constructed. This reactor system is now fully operable and we are routinely collecting kinetics data at temperatures in the range of 550-900°C and pressures of 1 to 15 atm. Samples of nine candidate calcium-based sorbents were acquired and tested. These samples were subjected to reaction screening tests as part of Task 2. As a result of these screening tests, chemically pure calcium carbonate, chemically pure calcium acetate, and the commercial dolomite were selected for more detailed kinetic testing. In Task 3, the HTHP electrobalance reactor is being used to study the calcination-carbonation behavior of the three base sorbents as a function of calcination temperature, carbonation temperature, carbonation pressure, and CO_2 concentration.

26 (DOE/PC/89869–T7) **Development of a stable cobalt-ruthenium Fischer-Tropsch catalyst: Technical progress reports No. 7 and 8, April 1, 1991–September 30, 1991.** Abrevaya, H. UOP, Inc., Des Plaines, IL (United States). [1991]. 42p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-89PC89869. Order Number DE92041239. Source: OSTI; NTIS; GPO Dep.

The objective of this contract is to examine the relationship between catalytic properties and the function of cobalt Fischer-Tropsch catalysts and to apply this fundamental knowledge to the development of a stable cobalt-based catalyst with a low methane-plus-ethane selectivity for use in slurry reactors. An experimental cobalt catalyst 585R2723 was tested three times in the fixed-bed reactor. The objective of the tests was to identify suitable testing conditions for screening catalyst. The α-alumina was determined to be a suitable diluent medium for controlling the catalyst bed temperature close to the inlet temperature. With 13 g of catalyst and 155 g of diluent, the catalyst maximum temperature were within 2°C from the inlet temperatures. As a result of this work, 210°C and 21 atm were shown to result in low methane selectivity and were used as initial conditions in the catalyst screening test. Ethane, which along with methane is undesirable, is typically produced with low selectivity and follows the same trend as methane. Other work reported here indicated that methane selectivity increases with increasing temperature but is not excessively high at 230°C. Consequently, the catalyst screening test should include an evaluation of the catalyst performance at 230°C. During Run 67, the increase in temperature from 210°C to 230°C was initiated at 30 hours on-stream.

27 (DOE/PC/89869–T8) **Development of a stable cobalt-ruthenium Fischer-Tropsch catalyst: Technical progress report No. 9, October 1, 1991–December 31, 1991.** Abrevaya, H. UOP, Inc., Des Plaines, IL (United States). 26 Aug 1992. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-89PC89869. Order Number DE92041283. Source: OSTI; NTIS; GPO Dep.

The work performed in the program suggests that cobalt catalytic performance is a complex function of crystallite size, crystallite composition, and cobalt-support interaction. These properties are determined by the nature of support, the bimetallic component, the promoters, and the method of preparation. Results so far indicate that the lowest methane selectivity occurs on support No. 8, and the highest activity is obtained on support No. 10. Also, promoters 2 and 3 may help lower the formation of methane. These findings, along with the catalyst knowledge gained during Union Carbide's former contract AC22-84PC70028, will be used to develop a superior cobalt catalyst.

28 (DOE/PC/89883–45) **Coal liquefaction process streams characterization and evaluation: FT-IR methods for characterization of coal liquefaction products.** Serio, M.A. (Advanced Fuel Research, Inc., East Hartford, CT (United States)); Teng, H.; Bassilakis, R.; Solomon, P.R. Consolidation Coal Co., Library, PA (United States). Research and Development Dept.; Advanced Fuel Research, Inc., East Hartford, CT (United States). Apr 1992. 122p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-89PC89883. Order Number DE92041236. Source: OSTI; NTIS; GPO Dep.

This study was designed to demonstrate the use of two FTIR techniques for the analysis of direct coal liquefaction process-derived materials. The two methods were quantitative FTIR analysis and themogravimetric (TG) analysis with FTIR analysis of evolved products (TG-FTIR). The quantitative FTIR analyses of both whole resids and THF-soluble resids provided quantitation of total hydrogen, aliphatic and aromatic hydrogen, total carbon, total oxygen, hydroxyl and etheric oxygen, and ash contents. The FTIR results were usually in agreement with values derived by other, more conventional methods. However, the accuracies of specific measurements, in comparisons with results from conventional methods, ranged from good to poor. The TG-FTIR method provided approximate analyses of coals and resids. The data provided included the time dependent evolution profiles of the volatile species and the elemental composition of the char. Reproducible data of gaseous species and pyrolysis tar yields for whole resid samples larger than 10 mg were obtainable. The yields and evolution profiles of certain volatiles (tar, CO, and methane) provided structural

information on the samples. There were some experimental and interpretational difficulties associated with both techniques. Optimization of the curve-resolving routine for coal-liquefaction samples would improve the quantitative FTIR accuracy. Aerosol formation limited the full application of the TG-FTIR technique with the THF-soluble resid samples. At this time, further development of these analytical methods as process development tools will be required before their use for that purpose can be recommended. The use of FTIR as an on-line analytical technique for coal liquefaction process streams requires demonstration before it can be recommended; however, such a demonstration may be warranted.

29 (DOE/PC/89883–47) **Coal liquefaction process streams characterization and evaluation: Application of liquid chromatographic separation methods to THF-soluble portions of integrated two-stage coal liquefaction resids.** Green, J.B. (National Inst. for Petroleum and Energy Research, Bartlesville, OK (United States)); Pearson, C.D.; Young, L.L.; Green, J.A. Consolidation Coal Co., Library, PA (United States). Research and Development Dept.; National Inst. for Petroleum and Energy Research, Bartlesville, OK (United States). May 1992. 45p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-89PC89883. Order Number DE92041235. Source: OSTI; NTIS; GPO Dep.

This study demonstrated the feasibility of using non-aqueous ion exchange liquid chromatography (NIELC) for the examination of the tetrahydrofuran (THF)-soluble distillation resids and THF-soluble whole oils derived from direct coal liquefaction. The technique can be used to separate the material into a number of acid, base, and neutral fractions. Each of the fractions obtained by NIELC was analyzed and then further fractionated by high-performance liquid chromatography (HPLC). The separation and analysis schemes are given in the accompanying report. With this approach, differences can be distinguished among samples obtained from different process streams in the liquefaction plant and among samples obtained at the same sampling location, but produced from different feed coals. HPLC was directly applied to one THF-soluble whole process oil without the NIELC preparation, with limited success. The direct HPLC technique used was directed toward the elution of the acid species into defined classes. The non-retained neutral and basic components of the oil were not analyzable by the direct HPLC method because of solubility limitations. Sample solubility is a major concern in the application of these techniques.

30 (DOE/PC/90055–T5) **Technology development for iron Fischer-Tropsch catalysts: Technical progress report No. 4, June 26, 1991–September 26, 1991.** Frame, R.R. UOP, Inc., Des Plaines, IL (United States). 26 Aug 1992. 44p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-90PC90055. Order Number DE92041282. Source: OSTI; NTIS; GPO Dep.

The preparation of binderless iron oxide spheres has been achieved by a novel sol-gel forming procedure. The starting material is a solution of iron (III) 2-ethylhexanoate in mineral spirits. This solution is added dropwise to an ammoniacal solution of methanol. The low viscosity of the methanol causes the formation of small droplets of the iron solution. The immiscibility of the mineral spirit solution in the methanol and the difference in surface tensions cause the droplets to assume a spherical shape. The presence of ammonia and water at low levels in the methanol promotes the hydrolysis of the iron (III) 2-ethylhexanoate, which causes the spherical particles to harden. The iron-containing spheres can then be isolated by filtration. These spheres are the first ones reported to be made of 100% iron oxide and prepared without a binder. In the initial preparations, the spheres are 100 to 200 μm in diameter. Some problems remain to be resolved with this new method of preparation.

31 (DOE/PC/90289–T6) **Mild coal pretreatment to improve liquefaction reactivity: Quarterly technical progress report, March–May 1992.** Miller, R.L. Colorado School of Mines, Golden, CO (United States). Dept. of Chemical Engineering and Petroleum Refining. [1992]. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-90PC90289. Order Number DE92040772. Source: OSTI; NTIS; GPO Dep.

This report describes work completed during the seventh quarter of a three year project to study the effects of mild chemical pretreatment on coal dissolution reactivity during low severity liquefaction or coal/oil coprocessing. The overall objective of this research is to elucidate changes in the chemical and physical structure of coal by pretreatment with methanol or other simple organic solvent and a trace amount of hydrochloric acid and to study the influence of these changes on coal dissolution reactivity. This work is part of a larger effort to develop a new coal liquefaction or coal/oil coprocessing scheme consisting of three main process steps : (1) mild pretreatment of the feed coal to enhance dissolution reactivity and dry the coal, (2) low severity thermal dissolution of the pretreated coal to obtain a very reactive coal-derived residual material amendable to upgrading, and (3) catalytic upgrading of the residual products to distillate liquids. Work this quarter continued to focus on analytical characterization of untreated and treated Wyodak subbituminous coal and Illinois No. 6 bituminous coal. Small angle x-ray scattering was used to study changes in surface morphology of pretreated coal samples. Results indicated that no significant changes in either surface area or pore size distribution occur in either coal as a result of treatment with reethanol and HCl. Thus, the reactivity enhancement observed with pretreated Wyodak and Illinois No. 6 coals cannot be attributed to increased surface area or pore size distribution.

32 (DOE/PC/90305–T8) **Probe molecule studies: Active species in alcohol synthesis: 7th quarterly report, April 1992–June 1992.** Blackmond, D.G.; Wender, I.; Oukaci, R.; Wang, J. Pittsburgh Univ., PA (United States). Dept. of Chemical and Petroleum Engineering. Jul 1992. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-90PC90305. Order Number DE93001274. Source: OSTI; NTIS; GPO Dep.

The goal of this research is to develop a better understanding of the mechanisms of formation of alcohols and other oxygenates from syngas over supported catalysts. Probe molecules will be added in situ during the reaction to help delineate reaction pathways and identify reaction intermediate species. The key of our study is to investigate how the species generated by these probe molecules interact with surface species present during oxygenate formation. (A) Co (5%) /Cu/ZnO/Al_2O_3 was prepared in order to obtain high rates of ethanol and propanol formation from CO hydrogenation. (B) The effect of CH_3NO_2 addition to the steady state CO hydrogenation over this Co(5%)/Cu/Zno/Al_2O_3 was investigated at 500 psi, 290°C, H_2:CO=2, and 7600 hr_{-1}. A simultaneous suppression of CH_3OH, C_2H_5OH, and 1-C_3H_7OH upon CH_3NO_2 addition was observed along with the formation of $(CH_3)_3N$. (C) C_2H_4 was also added as a probe molecule to the steady state CO hydrogenation over the same catalyst at the same condition. A significant increase in 1-propanol was observed upon C_2H_4 addition along with an equivalent decrease in methanol and dimethylether.

33 (DOE/PC/91040–T3) **Advanced direct liquefaction concepts for PETC generic units: Quarterly technical progress report, April 1992–June 1992.** Kentucky Univ., Lexington, KY (United States). Center for Applied Energy Research; Sandia National Labs., Albuquerque, NM (United States); Consolidation Coal Co., Pittsburgh, PA (United States); LDP Associates (United States). Aug 1992. 78p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-91PC91040. Order Number DE92041281. Source: OSTI; NTIS; GPO Dep.

CAER/UK: Detail coal and starting solvents from Wilsonville were analyzed to develop the data necessary to conduct process studies in the CO Pretreatment and Catalyst Evaluation segment of this program. A comparison of the solvent separation analysis with the distillation/separation used at Wilsonville showed that the residual solvent components contained a large amount of residual pentane soluble products. The ashy resid contained 3% iron and 400 ppM molybdenum. Although the iron content in the distillate and deashed resid was much less, namely about 200 ppM., the molybdenum concentrations in these fractions were not significantly reduced over the concentration in the ashy resid, i.e., 200 ppM in each. The pretreatment of coal with CO/H_2O in the presence of NaOH and Na_2CO_3 has been shown to give a product which is lower in oxygen content and higher in hydrogen content compared to the raw coal. The atomic H/C ratios of the H_2O-insolubles, THF

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insolubles and the PA+A fractions of the products-together with the hydrogen consumption data suggested that the raw coal has been substantially depolymerized and hydrogenated via the WGS reaction during the pretreatment process. The extensive amount of molecular reconstruction that has occurred in the solid product was evident from the ease of solubilization of the product into pyridine. The result of the pretreatment process is a product which is highly reactive under hydroliquefaction conditions at 400°C. Reaction rates seem to be much faster than the raw coal, especially at shorter reaction times, providing the opportunity for major reductions in plant vessel sizes, and preliminary data has led us to believe that better efficiency in hydrogen utilization is achieved.

34 (DOE/PC/91041–T1) **Preconversion processing of bituminous coals: New directions to improved direct catalytic coal liquefaction: Quarterly report, April 1, 1992–June 30, 1992.** BCR National Lab., Pittsburgh, PA (United States). Aug 1992. 27p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-91PC91041. (BCRNL-L–1663). Order Number DE93000302. Source: OSTI; NTIS; GPO Dep.

A study of high-temperature soaking has been continued. Two high-volatile bituminous coals and three coal liquids were used. Large pyridine extractabilities of more than 70 wt% were obtained for aR cases. A better understanding Of the mechanism is important for the development of coal preconversion using the high-temperature soaking. To investigate the mechanism of the change in coal solubilization by high-temperature soaking, a simple soaking experiment was conducted. The extract from the Illinois No. 6 coal was treated in toluene at three different temperatures, and the treated samples were analyzed by coal swelling using the recently developed method. Furthermore, effects of soaking time, soaking temperature, soluble portions, and coal rank were examined by using actual coal liquids. Although a cross-linked, three-dimensional macromoleculer model has been widely accepted for the structure of coat it has previously been reported that significant portions (far more generally believed) of coal molecules are physically associated. It is known, as reviewed in that paper, that most portions of bituminous coal can be disintegrated in coal derived liquids and polycyclic aromatic hydrocarbons at 300–400°C (high-temperature soaking). It was proposed that electron donors and acceptors of low molecular mass contained in these materials substitute coal-coal complexes with charge-transfer interactions. This is physical dissociation of associated coal molecules. However, chemical reactions may occur at these temperatures.

35 (DOE/PC/91041–T2) **Preconversion processing of bituminous coals: New directions to improved direct catalytic coal liquefaction: Quarterly report, September 20, 1991–December 31, 1991.** BCR National Lab., Pittsburgh, PA (United States). Jul 1992. 26p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-91PC91041. (BCRNL-L–1657). Order Number DE93000731. Source: OSTI; NTIS; GPO Dep.

The main task of this quarter was to install reactors to conduct preconversion and liquefaction of coal. Coal and coal liquids were collected. The anaerobic chamber (Model 855-AC; Plas Labs, inc.) was procured and set up to store coal samples under an inert gas. Equipment to treat products was assembled, including Soxhlet extraction units, fractionation columns, a distillation column, and a rotary evaporator. Two gas chromatographs for analysis of gases and liquid were adjusted. Two reactor systems were installed for the experimental apparatus. One was Model 4576 high-temperature and high-pressure autoclave (Parr Instrument, 500°C and 5000 psi) (see Figure 1); the other was a 27 ml of microreactors. The autoclave was obtained from the manufacturer and assembled. The experimental set-up of microreactors are shown in Figure 2.

36 (DOE/PC/91041–T3) **Preconversion processing of bituminous coals: New directions to improved direct catalytic coal liquefaction: Quarterly report, January 1, 1992–March 31, 1992.** BCR National Lab., Pittsburgh, PA (United States). Jul 1992. 24p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-91PC91041. (BCRNL-L–1658). Order Number DE93000732. Source: OSTI; NTIS; GPO Dep.

A study of the high-temperature soaking started in this quarter, following the installation of reactors in the previous quarter. Two high-volatile bituminous coals and three coal liquids, which were identified in the previous report, were used. A cross-linked, three-dimensional macromolecular model has been widely accepted f or the structure of coal, but there is no direct evidence to prove this model. The conventional coal structure model has been recently re-examined by this investigator because of the importance of relatively strong intra- and intermolecular interactions in bituminous coals. It was reasonable to deduce that significant portions were physically associated after a study of multistep extractions, associative equilibria, the irreversibility and the dependence of coal concentration on solvent swelling, and consideration of the monophase concept. Physical dissociation which may be significant above 300°C should be utilized for the treatment before liquefaction. The high-temperature soaking in a recycle oil was proposed to dissociate coal complexes.

37 (DOE/PC/91043–T3) **An investigation of the role of water on retrograde/condensation reactions and enhanced liquefaction yields: Quarterly progress report, April 1, 1992–June 30, 1992.** Miknis, F.P. Western Research Inst., Laramie, WY (United States). Jul 1992. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-91PC91043. Order Number DE92040540. Source: OSTI; NTIS; GPO Dep.

The overall objectives of this work are to conduct research that will provide the basis for an improved liquefaction process, and to facilitate our understanding of those processes that occur when coals are initially dissolved. Changes in coal structure that occur during coal drying and steam pretreatments will be measured in order to determine what effect water has on retrograde/condensation reactions, and to determine the mechanism by which water enhances coal reactivity toward liquefaction. Different methods for coal drying will be investigated to determine if drying can be accomplished without destroying coal reactivity toward liquefaction, thereby making coal drying a relatively economical and efficient method for coal pretreatment. Coal drying methods will include conventional thermal drying, microwave drying, and chemical drying at low temperature. State-of-the-art solid-state nuclear magnetic resonance (NMR) techniques using combined rotation and multiple pulse spectroscopy (CRAMPS) and cross polarization with magic-angle spinning (CP/MAS) will be employed: (1) to measures changes in coal structure brought about by the different methods of drying and by low temperature oxidation, and (2) to obtain direct measurements of changes in the aromatic hydrogen-to-carbon ratio of the solid/semi-solid material formed or remaining during pretreatment and the initial stages of liquefaction. The aromatic hydrogen-to-carbon ratios are difficult, if not impossible, to measure without the use of solid-state NMR, and as a result this ratio will be used to monitor the retrograde/condensation reactions that take place during coal liquefaction in the presence and absence of steam and various inert gases.

38 (DOE/PC/91058–T1) **Rate enhancement for catalytic upgrading coal naphthas: Quarterly project report, January–March 1992.** Davis, B.H. Kentucky Univ., Lexington, KY (United States). Center for Applied Energy Research. 4 Aug 1992. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-91PC91058. Order Number DE92040904. Source: OSTI; NTIS; GPO Dep.

A naphtha derived from Illinois #6 coal at the Wilsonville, Alabama pilot plant was hydrotreated and the raw naphtha and the product of hydrotreatment were examined by means of gas chromatography combined with mass spectrometry. The results obtained are summarized in Table 1. A representative chromatogram with the major peaks numbered as identified in Table 1 is shown in Figure 1. Mass spectra were obtained at elution peaks for most peaks exceeding 0.3% of total area; the areas were obtained using flame ionization detection. Approximately 95% of naphtha components were eluted during the time span covered in Table 1 for both the treated and untreated naphtha. In hydrotreatment lower molecular weight hydrocarbons tended to become more abundant at the expense of later eluting (higher molecular weight) components. The proportions of straight-chain alkanes were probably not significantly altered by hydrotreatment; an apparent exception, n-heptane, may involve co-elution, a possibility to be tested by selected ion chromatography. Phenols were removed by hydrotreatment. Trace

amounts of aromatic amines were detected in raw naphtha but not in the product of hydrotreatment. Trace amounts of sulfur-containing components are known to be present in raw naphtha, but were not detected in any of the mass spectra of the peaks reported here. Selected ion chromatography will be used to test for the presence of specific sulfur-containing components.

39 (DOE/PC/91058–T2) **Rate enhancement for catalytic upgrading coal naphthas: Quarterly project report, October–December 1991.** Davis, B.H. Kentucky Univ., Lexington, KY (United States). Center for Applied Energy Research. 4 Aug 1992. 30p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-91PC91058. Order Number DE92040905. Source: OSTI; NTIS; GPO Dep.

The construction and shake-down operation of two tricklebed reactor systems was completed. A mobile framework was constructed to support the two experimental systems. These two experimental systems were operated to perform hydrotreatment experiments using commercial catalysts and a Ill #6 coal derived naphtha. Unsupported transition metal sulfides were prepared following the procedure published by Chianelli et al. Conventionally, the transition metal sulfide have been prepared at high temperature (above 400°C) by vapor-phase reaction of the halides with hydrogen sulfide or by direct contact of the compounds in a sealed tube. The product is usually highly crystalline, has a low surface area and is often nonstoichiometric and multiphase. The technique presented by Chianelli et al involves precipitation of the amorphous transition metal sulfide from a nonaqueous solution. The corresponding transition metal halide and a sulfide source, i.e. a lithium salt (Li_2S or LiHS) and ammonium compounds, are used. This procedure yields materials of intermediate surface area. Hydroxyl containing solvents (alcohols and carboxylic acids) are too reactive generally to be employed as a solvent. The solvent used in the preparation of the transition metal sulfides was usually either ethyl acetate or tetrahydrofuran.

40 (DOE/PC/91286–T3) **The role of catalyst precursor anions in coal gasification: Third quarterly report.** Abotsi, G.M.K. Clark Atlanta Univ., GA (United States). Research Center for Science and Technology. 28 Aug 1992. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-91PC91286. Order Number DE92041240. Source: OSTI; NTIS; GPO Dep.

The aims of the proposed project are to enrich our understanding of the roles of various aqueous soluble catalyst precursor anions on the surface electrical properties of coal and to ascertain the influence of the surface charge on the adsorption, dispersion, and activities of calcium and potassium. These goals will be achieved by impregnating a North Dakota lignite (PSOC 1482) and its demineralized derivative with calcium or potassium catalyst precursors containing acetate (CH_3COO^-), chloride (Cl^-), nitrate (NO_3^-), sulfate (SO_4^{2-}), and carbonate (CO_3^{2-}) anions. Catalyst loading will be conducted under well-controlled conditions of solution pH and ionic strength. In the last quarter, the surface charge properties of the coal was determined as a function of acetate (CH_3COO^-), chloride (Cl^-), nitrate (NO^{3-}), carbonate (CO_3^{2-}) or sulfate (SO_4^{2-})concentration using the respective potassium salts of these anions. In general, low anion concentrations (10^{-3} or 10^{-2} mol/L) had little effect on the zeta potentials of the coals. However, the surface charge densities of the coal become less negative at 10-1 mol/L of the nitrate, carbonate or sulfate anions. These trends suggest that the surface charge density of the coal is controlled by the adsorption of potassium ions (K^+) onto the coal particles. The net negative charge on the coal panicles creates a repulsive force between the anions and the coal surface and prevents the anions from exerting any significant effect on the coal's electrokinetic properties.

41 (DOE/PC/91334–T71) **Mild pyrolysis of selectively oxidized coals: [Quarterly] technical report, March 1, 1992–May 31, 1992.** Hippo, E.J.; Palmer, S.R. Southern Illinois Univ., Carbondale, IL (United States). Dept. of Mechanical Engineering and Energy Processes. [1992]. 24p. Sponsored by USDOE, Washington, DC (United States); Illinois Dept. of Energy and Natural Resources, Springfield, IL (United States). DOE Contract FG22-91PC91334. Order Number DE93000521. Source: OSTI; NTIS; GPO Dep.

The primary objective of this study is to investigate the removal organic sulfur from selectively oxidized Illinois coals using mild thermal/chemical processes. Work completed this quarter primarily concerned the investigation of the desulfurization of the selectively oxidized coals using aqueous or alcoholic base mixtures. Model compound studies were initiated. Results were: Levels of desulfurization obtained in this study are at, or very close to, the 90% removal levels required for these coals to be in compliance with the Clean Air Act legislation; Up to 89.4% of the sulfur in the IBC 101 coal and 88.9% of the sulfur in the IBC 106 coal has been removed by combining selective oxidation and alcoholic/base reactions; Overall, selective oxidation pretreatment always led to a lower sulfur product than the untreated sample; Substantial enhancement in the reactivity of the sulfur in the coal has been achieved by the selective oxidation pretreatment; The highest levels of desulfurization obtained so far all involve bases as additives; The water/Na_2CO_3 combination, was superior than any of the aqueous hydroxide bases. Possible synergistic interactions between the alcohol and the base are suspected. Over 70% of the sulfur in the IBC 101 coal can be removed by performing vacuum pyrolysis on the selectively oxidized coal. Lower sulfur contents are obtained by lowing the pyrolysis pressure.

42 (DOE/PC/91334–T74) **Microbial strain improvement for organosulfur removal from coal: [Quarterly] technical report, March 1, 1992–May 31, 1992.** Kilbane, J.J. II. Institute of Gas Technology, Chicago, IL (United States). [1992]. 13p. Sponsored by USDOE, Washington, DC (United States); Illinois Dept. of Energy and Natural Resources, Springfield, IL (United States). DOE Contract FG22-91PC91334. Order Number DE93000523. Source: OSTI; NTIS; GPO Dep.

IGT has developed a microbial culture of Rhodococcus rhodochrous, designated as IGTS8, that is capable of specifically cleaving carbon-sulfur bonds in a range of organosulfur model compounds and is capable of removing organic sulfur from coal and petroleum without sacrificing the calorific value of the fuel. Although IGTS8 possesses the ability to specifically remove organic sulfur from coal, a major research need is to develop improved strains of microorganisms that possess higher levels of desulfurization activity and therefore will permit more favorable biodesulfurization process conditions: faster rates, more complete removal, and smaller reactor size. Strain improvement is the single most important aspect to the development of a practical coal desulfurization process and accordingly is the focus of research in this project. During the current quarter the screening of genomic libraries resulted in the detection of a clone that scored positively in the UV fluorescence spray plate assay; however, subsequent analysis failed to reveal the presence of a desulfurization gene. Preliminary results using subtractive hybridization to screen genomic libraries have been obtained but desulfurization genes have not yet been identified. In additional studies a gene encoding chloramphenicol resistance in Rhodococcus cultures has been cloned and the promoter region is currently being sequenced. This promoter will subsequently be used to obtain high levels of expression of desulfurization genes.

43 (DOE/PC/91334–T75) **The effects of moderate coal cleaning on the microbial removal of organic sulfur: [Quarterly] technical report, March 1, 1992–May 30, 1992.** Srivastava, V.J.; Kilbane, J.J. II. Institute of Gas Technology, Chicago, IL (United States). [1992]. 13p. Sponsored by USDOE, Washington, DC (United States); Illinois Dept. of Energy and Natural Resources, Springfield, IL (United States). DOE Contract FG22-91PC91334. Order Number DE93000524. Source: OSTI; NTIS; GPO Dep.

The purpose of this project is to investigate the possibilities of developing an integrated physical/chemical/microbial process for the precombustion removal of sulfur from coal. Microorganisms are capable of specifically cleaving carbon-sulfur bonds and removing substantial amounts of organic sulfur from coal; however, the removal of organic sulfur from coal by microorganisms is hampered by the fact that, as a solid substrate, it is difficult to bring microorganisms in contact with the entirety of a coal sample. This study will examine the suitability of physically/chemically treated coal

samples for subsequent biodesulfurization. During this quarter tests were performed involving prolonged (7 day) exposure to chemical comminution agents followed by explosive comminution. Combined chemical plus physical comminution yielded only minor differences between the chemical treatments tested (0.IN NAOH, methanol plus 0.IN NAOH, isopropanol plus 0.IN NAOH, and ammonia vapor) as regards particle size distribution. The densities of treated products varied somewhat with 0.IN NaOH and ammonia yielding the lowest and highest densities respectively. Biodesulfurization tests indicate that pre-grown IGTS8 biocatalysts can be used to desulfurized chemically treated IBC-107 coal.

44 (DOE/PC/91334–T85) **Protocols for the selective cleavage of carbon-sulfur bonds in coal: Technical report, March 1, 1992–May 30, 1992.** Bausch, M. (Southern Illinois Univ., Carbondale, IL (United States)). Illinois Dept. of Energy and Natural Resources, Springfield, IL (United States). [1992]. 24p. Sponsored by USDOE, Washington, DC (United States); Illinois Dept. of Energy and Natural Resources, Springfield, IL (United States). DOE Contract FG22-91PC91334. Order Number DE93000534. Source: OSTI; NTIS; GPO Dep.

Chemical reactions that result in carbon-sulfur bond cleavage are an essential aspect of any protocol designed to remove organic sulfur from coal. Unfortunately, several classes of reactions that lead to carbon-sulfur bond cleavage are not well understood. Planned in "Protocols for the Selective Cleavage of Carbon-Sulfur Bonds in Coal" are reactions in which organic sulfur-containing coal model compounds are subjected to different conditions of temperature, solvent mixtures and radiation. Summarized in this quarterly report are results of our investigations of the following topics: (a) the reactions of coal model compounds, namely, benzyl phenyl sulfide (BPS), diphenyl sulfide (hereafter referred to as phenylsulfide, PS) and dibenzothiophene (DBT) with various reagents (Lewis acid catalysts, radical initiators, electron acceptors) using different solvents and temperature in an attempt to maximize the degree of carbon-sulfur (C-S) bond cleavage; and (b) the results of photooxidation of coal model compounds under controlled conditions. Quantitative product analyses are presented in this report.

45 (DOE/PC/91334–T88) **Coal-derived promoters for the liquefaction of Illinois coal: Technical report, March 1–May 31, 1992.** Carty, R.H. (Institute of Gas Technology, Chicago, IL (United States)); Knight, R.A. Illinois Dept. of Energy and Natural Resources, Springfield, IL (United States). [1992]. 23p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-91PC91334. Order Number DE93000958. Source: OSTI; NTIS; GPO Dep.

The objective of this program is to investigate the use of liquids derived from coal either by mild gasification (MG) or supercritical extraction (SCE) to promote direct liquefaction of Illinois coal. Some organic heteroatomic compounds have been found to enhance liquefaction reactions. The approach taken in this two-year program is to use recently developed molecular probe techniques to assess the reactivity of three coal-derived liquids with respect to (A) H transfer rate, (B) C-C bond cleavage rate, (C) free radical flux, and (D) hydrocracking activity. With the IFFR liquid, the H transfer rate showed a mean increase of 21%, C-C bond cleavage selectivity increased by 34%, free radical flux showed a mean increase of 107%, and overall mean hydrocracking activity increased by 269%. For the ST/FBR liquid, H transfer rate increased 7%, C-C bond cleavage selectivity increased 27%, free radical flux increased 101%, and data indicated a 227% increase in hydrocracking activity. During the current quarter, the SCE liquid was characterized and tested. The H transfer rate did not increase, the mean free radical flux increased by 18%, and the hydrocracking activity showed a dramatic increase of 359%, which is higher than either the IFFR or ST/FBR liquids. The assessment of C-C bond cleavage with SCE is not yet completed. The SCE analysis showed much lower levels of phenols, cresols, and naphthalenes than the IFFR and ST/FBR liquids.

46 (DOE/PC/91334–T95) **Gasifier feed - Tailor-made from Illinois coals: [Quarterly] report, March 1, 1992–May 31, 1992.** Ehrlinger, H.P. III (Illinois State Geological Survey, Champaign, IL (United States)); Lytle, J.; Frost, R.R.; Lizzio, A.; Kohlenberger, L.; Brewer, K. Illinois State Geological Survey, Champaign, IL (United States). [1992]. 14p. Sponsored by USDOE, Washington, DC (United States); Illinois Dept. of Energy and Natural Resources, Springfield, IL (United States). DOE Contract FG22-91PC91334. Order Number DE93000948. Source: OSTI; NTIS; GPO Dep.

The main purpose of this project is to produce a feedstock from preparation plant fines from an Illinois coal that is ideal for a slurry fed, slagging, entrained-flow coal gasifier. The high sulfur content and high Btu value of Illinois coals are particularly advantageous in such a gasifier; preliminary calculations indicate that the increased cost of removing sulfur from the gas from a high sulfur coal is more than offset by the increased revenue from the sale of the elemental sulfur; additionally the high Btu Illinois coal concentrates more energy into the slurry of a given coal to water ratio. This project will bring the expertise of four organizations together to perform the various tasks. The Illinois Coal Association will help direct the project to be the most beneficial to the Illinois coal industry. DESTEC Energy, a wholly-owned subsidiary of Dow Chemical Company, will provide guidelines and test compatibility of the slurries developed for gasification feedstock. Williams Technology will provide their expertise in long distance slurry pumping, and test selected products for viscosity, pumpability, and handlability. The Illinois State Geological Survey will study methods for producing clean coal/water slurries from preparation plant wastes including the concentration of pyritic sulfur into the coal slurry to increase the revenue from elemental sulfur produced during gasification operations, and decrease the pyritic sulfur content of the waste streams. ISGS will also test the gasification reactivity of the coals. As reported earlier, a variety of possible samples of coal have been analyzed and the gasification performance evaluation reported. Additionally, commercial sized samples of -28 mesh x 100 mesh coal -100 x 0 coal were subjected to pumpability testing. Neither the coarse product nor the fine product by themselves proved to be good candidates for trouble free pumping, but the mix of the two proved to be a very acceptable product.

47 (DOE/PC/91334–T99) **Stabilization and/or regeneration of spent sorbents from coal gasification: [Quarterly] technical report, March 1, 1992–May 31, 1992.** Abbasian, J. (Institute of Gas Technology, Chicago, IL (United States)); Hill, A.H.; Wangerow, J.R. Illinois Dept. of Energy and Natural Resources, Springfield, IL (United States). [1992]. 13p. Sponsored by USDOE, Washington, DC (United States); Illinois Dept. of Energy and Natural Resources, Springfield, IL (United States). DOE Contract FG22-91PC91334. Order Number DE93000943. Source: OSTI; NTIS; GPO Dep.

The objective of this investigation is to determine the effects of SO_2 partial pressure and reaction temperature on the conversion of sulfide containing solid wastes from coal gasifiers to stable and environmentally acceptable calcium sulfate, while preventing the release of sulfur dioxide through undesirable side reactions during the stabilization step. An additional objective of this program is to investigate the use of the Spent Sorbent Regeneration Process (SSRP) to regenerate spent limestone, from a fluidized-bed gasifier with in-bed sulfur capture, for recycling to the gasifier. To achieve these objectives, selected samples of partially sulfided sorbents will be reacted with oxygen at a variety of operating conditions under sufficient $S0_2$ partial pressure to prevent release of sulfur from the solids during stabilization that reduces the overall sorbent utilization. Partially sulfided limestone will also be regenerated with water using the SSRP to produce calcium hydroxide and release sulfur as H_2S. The regenerated sorbent will be dewatered, dried and pelletized. The reactivity of the regenerated sorbent toward H_2S will also be determined.

48 (DOE/PC/91334–T101) **Development of novel copper-based sorbents for hot-gas cleanup: Technical report, March 1, 1992–May 31, 1992.** Abbasian, J. (Institute of Gas Technology, Chicago, IL (United States)); Hill, A.H.; Wangerow, J.R.; Flytzani-Stephanopoulos, M.; Bo, L.; Patel, C. Illinois Dept. of Energy and Natural Resources, Springfield, IL (United States). [1992]. 26p. Sponsored by USDOE, Washington, DC (United States); Illinois Dept. of Energy and Natural Resources, Springfield, IL (United States). DOE Contract FG22-91PC91334. Order Number DE93000941. Source: OSTI; NTIS; GPO Dep.

The objective of this investigation is to evaluate several novel copper-based binary oxides for their suitability as regenerable sorbents for hot gas cleanup application in the temperature range of 650° to 850°C. During this quarter cyclic sulfidation/regeneration tests of the sorbents Cu_2Cr-O and Cu-Ce-0 were conducted using different compositions of the feed gases to investigate the effects of H_20, H_2 and CO. These tests were conducted in a packed-bed microreactor at 850°C. The results of these tests showed that H_2 and CO (along with C02) had a significant effect on the H_2S prebreakthrough levels, whereas H_20 did not have an effect. The physical properties of the fresh and reacted samples of the Cu-2Cr-O and Cu-Ce-0 sorbents prepared in this program and used in the cyclic sulfidation/regeneration tests were also measured. In addition, sulfidation/regeneration tests were conducted using two commercial copper chromite sorbents (G-13 and G-89, United Catalyst, Inc.) and a zinc titanate sorbent (L-3014) in a one-inch fluidized-bed reactor at 650°C. The G-13 sorbent appears to have a much higher sulfur capacity than the G-89 sorbent.

49 (DOE/PC/91334–T102) **Desulfurization of hot fuel gas produced from high-chlorine Illinois coals: Technical report, March 1, 1992–May 31, 1992.** O'Brien, W.S. (Southern Illinois Univ., Carbondale, IL (United States)); Gupta, R.P. Illinois Dept. of Energy and Natural Resources, Springfield, IL (United States). [1992]. 20p. Sponsored by USDOE, Washington, DC (United States); Illinois Dept. of Energy and Natural Resources, Springfield, IL (United States). DOE Contract FG22-91PC91334. Order Number DE93000940. Source: OSTI; NTIS; GPO Dep.

New coal gasification processes are now being developed which can generate electricity with high thermal efficiency either in an integrated gasification combined cycle (IGCC) or in a fuel cell (MCFC). Both of these new coal-to-electricity pathways require that the coal-derived fuel gas be at a high temperature and be free of potential pollutants, such as sulfur compounds. Unfortunately, some high-sulfur Illinois coals also contain significant chlorine which converts into hydrogen chloride (HCl) in the coal-gas. This project investigates the effect of HCl, in concentrations typical of a gasifier fed by high-chlorine Illinois coals, on zinc-titanate sorbents that are currently being developed for H_2S and COS removal from hot coal gas. This study is designed to identify any deleterious changes in the sorbent caused by the HCl, both in absorptive operation and in the regeneration cycle, and will pave the way to modify the sorbent formulation or the process operating procedure to remove HCl along with the H_2S and COS from hot coal gas. This will negate any harmful consequences of utilizing high-chlorine Illinois coal in these processes. The work activity during the third quarter of this project involved the performance of the second block-set of experiments in the bench-scale fluidized-bed reactor. These experiments were designed to study the effect of HCl in the desulfurization of a low-Btu fuel gas. Nine single-cycle experiments were performed, at operating temperature of 538, 650, and 750°C, with HCl concentrations of 0, 200, and 800 ppMv. The presence of HCl in the coal gas significantly enhanced the desulfurization efficacy of the sorbent. A 10-cycle sulfidation-regeneration sequence is currently being performed at 650°C with 800 ppMv HCl in the simulated fuel gas to determine any adverse effects on the sorbent structure or its desulfurization capability.

50 (ECN-C–92-043) **Inventarisation of techniques for CO_2 removal from fuel gas or reformer gas.** Oudhuis, A.B.J. Netherlands Energy Research Foundation (ECN), Petten (Netherlands). Jul 1992. 28p. Contract VROM 651.893.01 160439. Order Number DE92557284. Source: OSTI; NTIS (US Sales Only).

A literature study into the gas separation processes for CO_2 removal from fuel gas or reformer gas was performed by the Netherlands Energy Research Foundation (ECN) on behalf of the Dutch Ministry of Housing, Planning and Environment (VROM) and the ECN energy research programme ENGINE (ENergy Generation In the Natural Environment). The result of this study is the selection of the most convenient technique for the specified cases of CO_2 removal from fuel gas or reformer gas. The fuel gas will be produced by coal gasification, while the reformer gas will be produced by reforming natural gas. Implementation of a CO-shift reactor will increase the efficiency of separation (increase of the CO_2 as well as the H_2 concentration). The resulting H_2-rich stream will be converted in a combined cycle. Chemical absorption, physical absorption, adsorption in a molecular sieve (PSA or Pressure Swing Adsorption) and membrane separation are possible techniques for CO_2 separation. The fact that the resulting CO_2 stream must have a purity of >95%, makes the chemical or physical absorption techniques most attractive. In the case of CO_2 removal from reformer gas, chemical absorption is favoured because of a CO_2 partial pressure lower than 5 bar. Activated MDEA (methyldiethanolamine) is the recommended CO_2 absorption technique, because it combines the selectivity of a chemical absorbent with the low energy requirement of a physical absorbent. In the case of CO_2 removal from fuel gas, physical absorption is favoured because of a CO_2 partial pressure higher than 5 bar. Selexol is the recommended CO_2 absorption technique, because of the low energy requirement and the possibility to selectively absorb CO_2 and H_2S. 6 figs., 22 refs., 1 app.

51 (ORNL/FMP–92/1) **Proceedings of the sixth annual conference on fossil energy materials: Fossil Energy AR and TD Materials Program.** Cole, N.C.; Judkins, R.R. (comps.). Oak Ridge National Lab., TN (United States). Jul 1992. 428p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. (CONF-9205123–: 6. annual fossil energy materials conference, Oak Ridge, TN (United States), 12-14 May 1992). Order Number DE93000504. Source: OSTI; NTIS; GPO Dep.

The Sixth Annual Conference on Fossil Energy Materials was held in Oak Ridge, Tennessee, on May 12–14, 1992. The meeting was sponsored by the US Department of Energy's Office of Fossil Energy through the Advanced Research and Technology Development (AR&TD) Materials Program, and ASM International. The objective of the AR&TD Materials Program is to conduct research and development on materials for longer-term fossil energy applications as well as for generic needs of various fossil fuel technologies. The management of the Program has been decentralized to the DOE Field Office, Oak Ridge with Oak Ridge National Laboratory (ORNL) as the technical support contractor. The research is performed by staff members at ORNL and by a substantial number of researchers at other national laboratories, universities, and in private industry. The work is divided into the following categories: (1) ceramics, (2) development and corrosion resistance of iron aluminide, advanced austenitic and chromium-niobium alloys, and (3) technology assessment and technology transfer. This conference is held each year to review the work on all of the projects of the Program. The agenda for the meeting is given in Appendix A, and a list of attendees is presented in Appendix B. ASM International cosponsored the conference, for which we are especially grateful.

52 (SAND–92-1989C) **Fine-particle iron catalysts: Testing program at Sandia National Laboratories.** Stohl, F.V. Sandia National Labs., Albuquerque, NM (United States). [1992]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-9210165–1: 9. AIST-NEDO/DOE-PETC joint technical meeting on coal liquifation, San Francisco, CA (United States), 12-15 Oct 1992). Order Number DE92040966. Source: OSTI; NTIS; GPO Dep.

The use of fine-particle size (<40 nm) unsupported catalysts in the solubilization step of direct coal liquefaction may result in improved economics for direct coal liquefaction due to the possible enhanced yields of desired products, the potential for decreasing reaction severity, and the possibility of using less supported catalyst during liquefaction processing. To guide the research and development efforts for these new unsupported catalysts, it is necessary to evaluate the catalyst performance under standard test conditions so that the impacts of catalyst formulations from different laboratories can be compared. The objectives of this work are to develop standard coal liquefaction test procedures and to perform the testing of the novel fine-particle size liquefaction catalysts being developed in the DOE/PETC AR Coal Liquefaction program. As part of this effort, we have developed a factorial experimental design to enable evaluation of the catalysts over ranges of temperature, time, and catalyst loading. The standard test procedure uses DECS-17 Blind Canyon Coal and 9,10-dihydrophenanthrene (DHP) as the hydrogen donor. Product analyses include tetrahydrofuran (THF) conversion, heptane conversion, DHP recovery, and gas

analyses. THF and heptane insoluble materials are analyzed for carbon, hydrogen, nitrogen and sulfur contents. Testing is performed in batch microautoclave reactors. The experimental design and test procedures are being evaluated using −100 mesh pyrite as a catalyst.

53 (SRI–2847-9) **Fundamental studies of coal liquefaction solvents: Quarterly report No. 3, April 1–July 1, 1992.** Ross, D.S. SRI International, Menlo Park, CA (United States). Chemistry Lab. 1 Aug 1992. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-91PC91053. Order Number DE93000919. Source: OSTI; NTIS; GPO Dep.

We have conducted some initial "get acquainted" runs with Wyodak coal and water. These runs allowed us to learn the basic features of its operation, and to make any necessary refinements. Some trial and error adjustments in the imaging system were required initially, and there are likely some additional improvements to be made. The two most recent runs were satisfactory. The cell was heated at around 10°C/min. We appear to see the evolution of tar from the coal particles at temperatures in the range 150°–300°C, although some upgrading in the image sharpness is required for a full evaluation of the process. Above 300°C the process subsides, and at around 3500 the optical qualities of water deteriorate as the medium approaches its critical temperature (374°C). Image becomes chaotic, although for moments at a time some of the particles can be seen. The coal does not appear to be affected by the critical nature of the medium. The image returns at around 400°C, and to 450° little change is seen. We are able to discern particles down to about 5μ in diameter. Brownian motion of the particles is apparent from around 150° to 300°C. At that point the motion ceases, presumably because the density of the medium falls substantially from that point on with increasing temperature.

0105 Products and By-Products

54 (NEDO-P–9115) **Study on possibility of the system introducing coalbed methane source.** New Energy and Industrial Technology Development Organization, Tokyo (Japan). Mar 1992. 117p. (In Japanese). Sponsored by New Energy and Industrial Technology Development Organization, Tokyo (Japan). Order Number DE93723967. Source: OSTI; NTIS.

Studies are made on optimization of the system for converting coalbed methane (CBM) to methanol in its producing area and transporting it to Japan. CBM is a gas mainly with methane in the coal layer, CBM Of 24 trillion m_3 exists in the U.S., Canada, China and Australia. The methanol production method using this CBM as a raw material is the combined process mainly with a steam reforming process, but the gas phase fluidized bed process and the low temperature liquid phase process are promising as a future development technology. Japan's methanol supply/demand is 1.8 million tons in 1991, 95% of which are imported. Most of the CBM is used as chemical raw materials, and the use of it as gasoline additive MTBE will extend. Trial estimation including methanol production up to transportation to Japan is made. In case of a CBM price of 0.58 yen/10^3 kcal, its receiving price is 10-19 yen/kg. There is a possibility of converting methanol from the conventional natural gas to that from CBM used for chemical raw materials. Also as a fuel, CBM is on the same price level as LNG and has a possibility of commercialization. 29 refs., 24 figs., 46 tabs.

0106 Properties and Composition

Refer also to citation(s) 9, 31, 75, 92, 1238

55 (DOE/PC/79901–T5) **Radiative properties of ash and slag: Tenth quarterly report, January 1, 1990–March 30, 1990.** Solomon, P.R.; Markham, J.R. Advanced Fuel Research, Inc., East Hartford, CT (United States). [1990]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-87PC79901. Order Number DE92041110. Source: OSTI; NTIS; GPO Dep.

Thermal radiation plays a key role in the operation and efficiency of combustion systems, accounting for over 90% of the heat transfer. The analysis of radiative heat transfer in coal-fired boilers, combustion chambers and other energy systems requires accounting for the effects of inorganic deposits on bounding surfaces and of entrained particulates, such as pulverized coal, char, and fly-ash. These effects can be predicted; however, the accuracy in predicting the radiative properties of entrained pyrolysis (ash) and deposit layers (slag) is limited by inaccurate knowledge of the physical/chemical properties of the materials over a range of material temperatures and radiative wavelengths that is representative of conditions in practical combustion systems. The objective of this project is to make laboratory measurements of the radiative properties of extracted ash and slag deposit samples and compare to model predictions.

56 (DOE/PC/79901–T7) **Radiative properties of ash and slag: Eighth quarterly report, July 1, 1989–September 30, 1989.** Solomon, P.R.; Markham, J.R. Advanced Fuel Research, Inc., East Hartford, CT (United States). Oct 1989. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-87PC79901. Order Number DE92041112. Source: OSTI; NTIS; GPO Dep.

Thermal radiation plays a key role in the operation and efficiency of combustion systems, accounting for over 90% of the heat transfer. The analysis of radiative heat transfer in coal-fired boilers, combustion chambers and other energy systems requires accounting for the effects of inorganic deposits on bounding surfaces and of entrained particulates, such as pulverized coal, char, and fly-ash. These effects can be predicted; however, the accuracy in predicting the radiative properties of entrained pyrolysis (ash) and deposit layers (slag) is limited by inaccurate knowledge of the physical/chemical properties of the materials over a range of material temperatures and radiative wavelengths that is representative of conditions in practical combustion systems. The objective of this project is to make laboratory measurements of the radiative properties of extracted ash and slag deposit samples. During this quarter, measurements were continued for fused, tintered and powdery deposits.

57 (DOE/PC/79903–T15) **Optical properties of flyash: Quarterly report, 1 January–31 March 1990.** Self, S.A. Stanford Univ., CA (United States). High Temperature Gasdynamics Lab. Apr 1990. 38p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-87PC79903. Order Number DE93001869. Source: OSTI; NTIS; GPO Dep.

In this research program, we have adopted the approach that by measuring fundamental properties (i.e, the complex refractive index, m) of the fly ash which participates in the radiation transfer, we can use well established theoretical principles (Mie theory) to compute the radiative properties of dispersions of fly ash as found in coal combustors. With this approach one can, understand the underlying principles that affect the radiative properties of an ash dispersion and more confidently predict how variations in the characteristics of the ash dispersion cause variations in its radiative properties. An important criterion in this approach is that the fly ash particles be spherical, homogeneous, and isotropic. Fortunately, fly ash particles are formed at high temperatures at which most of them are molten, leading primarily to spherical particles. Furthermore, one should expect that molten particles will be reasonably homogeneous and isotropic. On cooling, most fly ash particles form glassy spheres which are homogeneous and isotropic. Some ash particles form hollow shells (cenospheres) while others form as particles with "bubbles" or voids, but most fly ash particles are well approximated as homogeneous isotropic spheres. In the following sections we review some of the underlying principles that affect the radiative properties of fly ash dispersions and report on progress that has been made during the past quarter.

58 (DOE/PC/79903–T17) **Optical properties of flyash: Quarterly report, 1 April–30 June 1989.** Self, S.A. Stanford Univ., CA (United States). High Temperature Gasdynamics Lab. Jul 1989. 49p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-87PC79903. Order Number DE93001870. Source: OSTI; NTIS; GPO Dep.

The purpose of this task is to validate the whole approach adopted in this program. Specifically, this bench-scale experiment is intended to compare the measured optical/radiative properties of a dispersion of well characterized ash with those calculated on the basis of the known size/composition distribution using the correlation formulae relating the composition and complex refractive index

resulting from measurements on bulk samples of synthetic slag. Considerable thought has been given to the various possible approaches to satisfying the objectives of this task. Several experiments were done to guide our design of an apparatus for measuring the scattering and absorption properties of dispersions of flyash. As a result of these experiments, and from extensive prior experience in connection with research on electrostatic precipitation, it has been determined that there is no satisfactory way to satisfy the aims of this task using a gaseous dispersion of flyash because it is not possible to adequately disperse and deagglomerate flyash into a gas stream. Unless the ash is adequately dispersed, as it exists in the radiant boiler of a pulverized coal-fired combustion system, one cannot expect calculations, based on Mie calculations for a dispersion of spheres to properly agree with laboratory measurements. For these reasons, our design efforts are based on making measurements on a dispersion of flyash in liquid, for which our experience shows we can obtain stable, well-deagglomerated dispersions of ash. Because there is not single liquid which is adequately transparent over the wavelength range 1–12 μm, we plan to use a combination of three liquids, C Cl_4, C S_2 and bromoform to cover the full range. Windows of BaF_2 will be used to contain the liquid suspension in an absorption/scattering cell.

59 (DOE/PC/89757–9) **Thermodynamics and surface structure of coals: Quarterly report, October 1, 1991–December 31, 1991.** Glass, A.S.; Larsen, J.W.; Quay, D.M.; Roberts, J.E. Lehigh Univ., Bethlehem, PA (United States). Dept. of Chemistry. [1991]. 35p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-89PC89757. Order Number DE92040015. Source: OSTI; NTIS; GPO Dep.

NMR relaxation and shift reagents are being deposited on the surface of coals. The dipolar coupling of the unpaired electron spin of the relaxation agent and the carbon atom should significantly shorten the carbon T, which should broaden it away. We propose to record the NMR spectrum of a coal before and after deposition and subtract the spectra. The difference spectra will arise from the functionalities within approximately one nanometer of the surface and reveal the surface composition of the coal. In order to determine the surface concentration of the dysprosium in the coal, we are using x-ray photoelectron spectroscopy (XPS) also known as electron spectroscopy for chemical analysis (ESCA). XPS is a surface technique that can be used for the elucidation of chemical structure. The binding energy for each electron in each element is unique. The measurement of the binding energy in XPS allows the identification of the element and its oxidation state. The relative atomic concentrations of each element can also be determined using XPS spectra.

60 (DOE/PC/90284–7) **Molecular accessibility in solvent swelled coal: Quarterly report.** Kispert, L.D. Alabama Univ., University, AL (United States). Dept. of Chemistry. Aug 1992. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-90PC90284. Order Number DE93000900. Source: OSTI; NTIS; GPO Dep.

An EPR technique developed in this lab is being used to determine the pore size and number distribution changes after swelling the coal samples with various solvents. Stable nitroxide radical spin probes of different sizes, shapes and reactivity are dissolved in an appropriate solvent, the coal sample is added to the resulting solution, stirred over night at elevated temperature, filtered, washed with a nonswelling solvent to eliminate any spin probes that are not trapped in the pores and the spin concentration measured. Comparing these spin probe measurements to DRIFT data have shown that the relative number distribution of acidic functionalities can be accurately predicted by the spin probe method. The spin probe method has also been used to predict the increase in elongated voids in Pittsburgh No. 8 (APCS No. 4) upon swelling with pyridine in agreement with independent SANS data. NMR relaxation data shows that it is possible to deduce the pore (accessibility) distribution as a function of size (up to 6 nm). It has also been possible by variable temperature and ENDOR measurements to determine the presence of hydrogen bonding as a function of pore shape and size. The advantage of the EPR method is that it permits molecules of selected shape and size to be used as probes of accessible regions of the coal, thus providing information on the importance of molecular shape.

61 (DOE/PC/90751–T14) **Transformations of inorganic coal constituents in combustion systems: Quarterly report No. 22, January 1–March 31, 1992.** Helble, J.J. (PSI Technology Co., Andover, MA (United States)); Boni, A.A.; Huggins, F.E.; Huffman, G.P.; Shah, N. PSI Technology Co., Andover, MA (United States). Jul 1992. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-86PC90751. (PSI–1024/TR-1206). Order Number DE92040531. Source: OSTI; NTIS; GPO Dep.

Results from recent UK chromium XAFS analysis of several coal and ash samples are reported. Illinois No. 6 parent coal, Illinois NO. 6 physically beneficiated coal, and two coals from the Penn State Coal Bank (DECS-2 and DECS-12), were found to contain chromium in the +3 oxidation state. No evidence for the carcinogenic and toxic +6 oxidation state (i.e., CrO_4^{-2}) was found. Ash samples were generated from each of these coals in a PSIT laboratory scale reactor at 1500°C and 7% oxygen. Subsequent XAFS analysis of these ash samples also identified only Cr+3 in the ash. As discussed further in Section 3, if the results of this study can be considered general for bituminous coals, then the absence of the (+6) chromate state in both the coal and the ash implies that the hazard posed by chromium in coal combustion is small, absent high concentrations of chromium in the ash (> 100 ppM). Of the two major oxidation states of chromium, the CrO_4^{-2} oxidation state can be both toxic and carcinogenic, whereas the Cr^{3+} oxidation state at such low concentration levels (< 100 ppM) does not pose a significant health risk. If the results of this study can be considered to be general, then the absence of the chromate state in both coal and combustion ash would imply that the hazard posed by chromium in coal utilization is minimal.

62 (DOE/PC/91334–T77) **Influence of sulfur in coals on char morphology and combustion: [Quarterly] technical report, March 1, 1992–May 31, 1992.** Marsh, H.; Crelling, J.C. Southern Illinois Univ., Carbondale, IL (United States). [1992]. 47p. Sponsored by USDOE, Washington, DC (United States); Illinois Dept. of Energy and Natural Resources, Springfield, IL (United States). DOE Contract FG22-91PC91334. Order Number DE93000526. Source: OSTI; NTIS; GPO Dep.

During coal pyrolysis, in applications such as in a utility boiler, sulfur which is present in the original coal is transferred to the resultant char, to be burnt (combusted) subsequently. The effect of sulfur on char reactivity during combustion is poorly understood and this study addresses the problem. Due to the complex nature of coal, initial experiments make use of organic model compounds which can be related to chars from coals. This approach allows for clear identification of the important parameters which influence reactivity, in this instance namely; phenolic resin concentration, sulfur and/or iron content. The addition of iron serves to mimic the effect of catalytic mineral matter in coals. The experimental approach involves the preparation of model compounds and the study of their gasification behavior, including surface characterization by adsorption techniques and microscopy. The equipment necessary to this study has been commissioned and progress has been made. Previous results indicated that increasing phenolic resin (resol) content led to greater yields and that carbons with less than 20 wt.% resol were optically anisotropic, whereas carbons with higher concentrations of resol were isotropic. Due to the high volatility of thiophene it was decided to incorporate sulfur into the model carbon structure by the addition of elemental sulfur and dibenzothiophene sulfone.

63 (DOE/PC/91334–T81) **Mass spectral study of organic sulfur in the polymeric matrix of coal: [Quarterly] technical report, March 1, 1992–May 31, 1992.** Hanley, L. Illinois Univ., Chicago, IL (United States). Dept. of Chemistry. [1992]. 14p. Sponsored by USDOE, Washington, DC (United States); Illinois Dept. of Energy and Natural Resources, Springfield, IL (United States). DOE Contract FG22-91PC91334. Order Number DE93000530. Source: OSTI; NTIS; GPO Dep.

This report reviews the progress of a project to examine the chemical environment of organic sulfur in the polymeric matrix of Illinois coal by laser desorption ion trap mass spectrometry. This project is developing new laser desorption-ionization schemes for

coal which preserve the polymeric matrix. It will compare mass spectra of whole coal with its separated macerals and will analyze organic sulfur in the polymeric matrix of coal by collision induced dissociation and high resolution mass spectrometry. A laser desorption mass spectrum of a trial polymer is shown to demonstrate the advantage of this technique over more traditional electron impact ionization mass spectrometry. A preliminary mass spectrum of THF extracts from a Herrin No. 6 (IBC 101) coal sample is also shown which contains low molecular weight fragments in the 60 to 250 amu region. Efforts are presently underway to obtain higher molecular weight ions from coal samples by optimizing the laser desorption conditions, improving the solvent extraction technique, and extending the mass range of the ion trap.

64 (DOE/PC/91334–T82) **Vhf EPR analysis of organic sulfur in coal: [Quarterly] technical report, March 1, 1992–May 31, 1992.** Clarkson, R.B.; Belford, R.L. Illinois Univ., Urbana, IL (United States). [1992]. 17p. Sponsored by USDOE, Washington, DC (United States); Illinois Dept. of Energy and Natural Resources, Springfield, IL (United States). DOE Contract FG22-91PC91334. Order Number DE93000531. Source: OSTI; NTIS; GPO Dep.

This third quarterly report of the project's first year reports that, consonant with our research goals, we have refined the quantitative measurement of organic sulfur in coals, and extended this technique to analysis of treated and desulfurized coals, using either low temperature pyrolysis in our labs, or other techniques as supplied by DOE-PETC. The evolution of the central carbon and downfield sulfur peak amplitudes vs pyrolysis temperature support both the hypothesis of increase in aromatic carbon radicals and the evolution of some sulfur, even at low temperatures. The examination of evacuation effects, and differentiation of species by microwave power saturation levels and second derivative W-band detection also continued. Finally, model sulfur-containing carbonaceous solids – chars from sucrose or cellulose, and various model sulfur compounds (elemental, mono- and di-thiophenic, and thiosulfidal) - are under development. Already, the W-band spectra of some of these char models show striking similarities to those of whole and treated coals. The further development of these models in conjunction with all other aspects of this program are progressing steadily toward the goal of better quantitative md qualitative differentiation of aromatic heteroatoms in coal.

65 (DOE/PC/91334–T83) **Analysis of organic sulfur and nitrogen in coal via tandem degradation methods: [Quarterly] technical report, 1 March–31 May 1992.** Kruge, M.A.; Palmer, S.R.; Baudet, N. Southern Illinois Univ., Carbondale, IL (United States). Dept. of Geology. [1992]. 26p. Sponsored by USDOE, Washington, DC (United States); Illinois Dept. of Energy and Natural Resources, Springfield, IL (United States). DOE Contract FG22-91PC91334. Order Number DE93000532. Source: OSTI; NTIS; GPO Dep.

Sporinite, vitrinite and semi-fusinite single macerals were separated from the IBC 101 coal by the density gradient technique. In addition, a gel permeation chromatography (GPC) system was assembled and the GPC column calibrated with four polystyrene molecular weight standards. A variety of sulfur compounds were identified in the dichromate oxidation products of the IBC 101 coal, including a thiazole and isomers of C2-, C3- and C4-alkyl thiophene carboxylic acids. Precise agreement between GC-MS and FPD chromatograms were obtained for these compounds. These compounds probably originated as short alkyl chains on exterior portions of the original peat macromolecular structures and were sulfurized by H_2S shortly after burial. Thus the dichromate oxidation appears useful for the characterization of sulfur compounds. Unfortunately, this treatment yields only small amounts of products, but the reaction is relatively mild. On the other hand the peroxyacetic acid gives a very good yield in only a single step, but seems to be very degradative. It was difficult to isolate the products after lithium aluminum hydride reduction of oxidation products. It is believed that this is due to the formation of polyalcohols from polycarboxyl compounds. However polyalcohols were successfully converted to their parent hydrocarbons by the LAH reduction of tosylate intermediates. This allows for much easier separation and characterization and leads to enhanced elucidation of coal structures. To test the hypothesis that asphaltenes are similar in structure to their parent coal, IBC101 asphaltenes and the extracted coal were subjected to PAA oxidation and analytical pyrolysis. The PAA products as well as the pyrolysates show very good correlation. This indicates a very strong relationship between the organic structure of the coal and that of the asphaltenes derived from them.

66 (DOE/PC/91334–T86) **Characterization of the surface properties of Illinois basin coals: Technical report, March 1, 1992–May 31, 1992.** Demir, I. (Illinois State Geological Survey, Champaign, IL (United States)); Harvey, R.D.; Lizzio, A.A. Illinois Dept. of Energy and Natural Resources, Springfield, IL (United States). [1992]. 24p. Sponsored by USDOE, Washington, DC (United States); Illinois Dept. of Energy and Natural Resources, Springfield, IL (United States). DOE Contract FG22-91PC91334. Order Number DE93000535. Source: OSTI; NTIS; GPO Dep.

The main objective of this project is to characterize the surface properties (surface area, pore size distribution, surface charge, and surface chemical structure) of eight coals in the Illinois Basin Coal Sample Program (IBCSP), and explore statistical relationships between surface properties and other coal characteristics. We completed analyses of -100 and -400 mesh, unoxidized IBCSP coals for surface area and pore volume distribution. Two thirds or more of the measured surface area of the samples are derived from the micropores (3.5-20 Å). The mesopore surface areas of IBC-101, IBC-102, and IBC-107 coals are higher than the other coals, and the mesopore surface area of the IBC-103 coal is the smallest among all the coals tested. The pore volume in pores less than about 1800 Å in diameter varies about five-fold among the samples. The differences between the samples suggest that these coals may show different physical-chemical behavior during various processes involving preparation and utilization of coal. Statistical analyses of the measured and other available coal properties indicate that the micropore surface area correlates positively with carbon content and vitrinite reflectance and negatively with volatile matter. and hydrogen content of the coal. The mesopore surface area correlates negatively with carbon content but positively with oxygen and hydrogen contents of the coal. The statistical correlations can be used to predict one parameter from another one.

67 (DOE/PC/91334–T87) **Graphic values for some organic constituents of beneficiated coal samples: Technical report, March 1, 1992–May 31, 1992.** Kohlenberber, L.B. (Illinois State Geological Survey, Champaign, IL (United States)); Lytle, J.M.; Kruse, C.W.; Chaven, C. Illinois Dept. of Energy and Natural Resources, Springfield, IL (United States). [1992]. 20p. Sponsored by USDOE, Washington, DC (United States); Illinois Dept. of Energy and Natural Resources, Springfield, IL (United States). DOE Contract FG22-91PC91334. Order Number DE93000536. Source: OSTI; NTIS; GPO Dep.

Graphic techniques exist which can accurately predict values for calorific value, organic sulfur, and several other constituents of the organic portion of beneficiated coal sample fractions. These techniques also permit a determination of coal rank to be made without the use of approximations required in the standard procedure. In beneficiation studies, plots of the calorific value of each fraction vs its ash content invariably produce straight lines. The Y axis intercept is the mineral-matter-free Btu value used (on the moist basis) to determine coal rank and the X axis intercept is a value we will call "maximum ash." These two constants permit us to calculate all future Btu values of fractions of this coal from the ash, alone. Plots of organic sulfur vs ash sometimes produce lines which are straight and at other times curved. In any event, they can be used to read off values of organic sulfur corresponding to a particular ash value in lieu of analyses. When all values truly represent only organic sulfur, the X axis intercept must occur at the same maximum ash value obtained from the Btu/ash curve. When the line is straight, the Y axis intercept is the mineral-matter-free organic sulfur, and all future organic sulfur values may be calculated from these 2 constants and the ash. Fractions of IBC-101 with varying ash contents were produced by froth flotation. The various fractions were analyzed by the coal analysis laboratory and the particular data type was plotted in each case vs the individual ash content of each fraction, using Lotus 123 and Freelance software packages. Such plots for calorific value and organic sulfur have, so far, been discussed in the second quarterly report. A comparison of the

graphic mineral matter value with the usual one calculated from the Parr approximation was also discussed in that report. In this third quarterly report we examine the curves for volatiles, fixed carbon, total carbon, total hydrogen, and nitrogen vs ash.

68 (DOE/PC/91334–T92) **Clean, premium-quality chars: Demineralized and carbon enriched: Quarterly report, March 1, 1992–May 31, 1992.** Smith, G.V. (Southern Illinois Univ., Carbondale, IL (United States)); Malhotra, V.M.; Wiltowski, T. Illinois Dept. of Energy and Natural Resources, Springfield, IL (United States). [1992]. 34p. Sponsored by USDOE, Washington, DC (United States); Illinois Dept. of Energy and Natural Resources, Springfield, IL (United States). DOE Contract FG22-91PC91334. Order Number DE93000951. Source: OSTI; NTIS; GPO Dep.

The effect of preoxidation on the interaction of methane and helium with IBC-102 coal samples ($\leq$ 2 mg) has been investigated in a thermogravimetric reactor at 20°C–650°C. The results show that the sample preoxidized at 80° C for 2 hr shows increased reactivity with both methane and He. Also, coal mixed with Camontmorillonite and preoxidized at 80°C exhibits the highest rate of devolatilization. Preoxidation of clean IBC-102 coal results in reactivity enhancement only under CH_4. This higher reactivity may be attributed to the oxidation of crude fractions present on the coal surface which may serve as a catalyst in methane interaction with coal. Differential Scanning Calorimetry (DSC) experiments show that kaolinite is effective agent for increasing yields of chars from IBC-102. Also, the clean coal (obtained by the selective-bitumen agglomeration process) shows enhanced weight loss in reaction with He. However, preoxidation of this coal increases the char yields. ISDR-FTIR results suggest that thermal decomposition of coal either increases $-CH_3$ content in char or alters the physical structure of $-CH_3$.

69 (NEDO-P–9113) **Survey on a new development of coal utilization technology in the coal science field. (2).** New Energy and Industrial Technology Development Organization, Tokyo (Japan). Mar 1992. 118p. (In Japanese). Sponsored by New Energy and Industrial Technology Development Organization, Tokyo (Japan). Order Number DE93723965. Source: OSTI; NTIS.

The paper examines the literature on molecular structure of coal, dynamic change of coal structure and catalyst in coal conversion process and considers the future molecular science and the trend of conversion process design based on it. Carbon of solid coal is quantified by bounding state by ^{13}C-NMR analysis, and covalent bond connecting aromatic clusters is estimated. The data obtained are compared with coal pyrolysis product distributions. It is necessary to continue to minimize and grasp the structure change by release of the covalent bond. To pursue the coal structure in the progress of pyrolysis is a fundamental for pyrolysis design. The change in the coal structure is caused by change/decomposition of coal functional groups, liberation of the polymer cross link, disconnection of the covalent bond. Coprocessing of coal and heavy oil is now under study mainly in the U.S. Heavy oil is expected to act as solvent and hydrogen donor solvent. The catalyst, which is to be disposable, is aimed at strengthening of the function by high dispersion in gasification, liquefaction and pyrolysis and at decrease of the amount to be used. 103 refs., 67 figs., 53 tabs.

70 (VTT-SYMP–134, pp. 101-115) **Rheological properties of wet peat.** Rautalin, A. (Technical Research Centre of Finland, Espoo (Finland). Lab. of Fuel and Process Technology); Thun, R.; Wilen, C. Technical Research Centre of Finland, Espoo (Finland). 1992. (CONF-9110428–: Conference on artificial dewatering of peat, Jyvaeskylae (Finland), 15-16 Oct 1991). In *Artificial dewatering of peat.* 149p. Order Number DE93721607. Source: OSTI; NTIS.

At Technical Research Centre of Finland alternative ways of overcoming flow problems with wet peat have been studied using mechanical maceration with and without chemical additives. The effect of various treatments on internal friction, cohesion, bulk density, shear strength and other flow-related properties has been investigated. Ring shear cells and purpose-built viscosimeters have been used for the determination of rheological characteristics of wet peat mass samples of varying moisture contents. The first results indicate that flow problems can be overcome by choosing proper treatment methods. As a consequence of alterations in the porous structure and rheological state of wet peat mass, decisively smaller pumping or driving forces are required in pipe transports.

0108 Waste Management

Refer also to citation(s) 12, 24

71 (ANL/CP–75263) **A chemical kinetic model for NO_x removal in an aqueous scrubber system using the additive Fe[II]·EDTA.** Mendelsohn, M.H.; Livengood, C.D. Argonne National Lab., IL (United States). [1992]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-920808–9: American Institute of Chemical Engineers (AIChE) summer national meeting, Minneapolis, MN (United States), 9-12 Aug 1992). Order Number DE92040750. Source: OSTI; NTIS; GPO Dep.

Addition of the metal chelate, ferrous· ethylenediaminetetraacetate anion ($Fe[II]\cdot EDTA^{2-}$), has been shown to increase the amount of gaseous nitrogen oxides absorbed from a gas stream containing sulfur dioxide, where an aqueous scrubbing process is used to treat the gas. Recently, we published data on improved systems for NO_x removal that incorporate an antioxidant and/or reducing agent (A/R) in the process along with the Fe[H]·EDTA. The purpose of the A/R is to maintain the highest possible concentration of iron in the +2 form. The major mechanism for NO removal is believed to be the equilibrium reaction of Fe[II]·EDTA with dissolved NO to form a Fe[II]·EDTA·NO complex. It has been shown that both sulfite and bisulfite anions can react with Fe[II]·EDTA·NO to regenerate Fe[II]·EDTA and other products. In a complex system, other oxidation and reduction mechanisms are also possible. We have chosen, therefore, to approach this problem empirically by fitting our experimental data to a model containing at most three kinetic terms, chosen from among the following: a baseline removal rate, which is equivalent to the rate of reaction of Fe[II]·EDTA with nitric oxide; a regeneration rate, which is equivalent to decomposition of the Fe[II]·EDTA·NO complex to Fe[II]·EDTA; an oxidation rate, which is a combined rate for all possible oxidation reactions involving Fe[II]·EDTA; and a reduction rate, which is a combined rate for all possible reduction reactions involving ferric-EDTA in the system.

72 (ANL/CP–75598) **Studies of waste produced in pilot-plant testing using Fe[II]·EDTA and magnesium-enhanced lime for combined SO_2/NO_x removal.** Mendelsohn, M.H. (Argonne National Lab., IL (United States)); Livengood, C.D.; Carlson, W.S.; Tutokey, S. Argonne National Lab., IL (United States); Dravo Lime Co., Pittsburgh, PA (United States). [1992]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-921037–4: 9. annual international Pittsburgh coal conference, Pittsburgh, PA (United States), 12-16 Oct 1992). Order Number DE92041101. Source: OSTI; NTIS; GPO Dep.

A pilot-plant-scale study of combined sulfur dioxide/nitrogen oxides removal has been performed by the Dravo Lime Company at the Cincinnati Gas & Electric Company's Miami Fort Station in North Bend, Ohio. This study used Dravo's patented Thiosorbic® lime process along with Argonne National Laboratory's (ANL's) patented ARGONOX ferrous·ethylenediaminetetraacetate anion (Fe(II)·EDTA) additive. For approximately nine months, scrubbing tests were collected and waste samples were collected. Waste testing at ANL involved two types of long-term chemical stability experiments. In one test, the gas-phase composition above several different samples was studied as a function of time. Significant changes were noted for both oxygen (0_2) and carbon dioxide (CO_2) gases. The other experiment involved solid-phase leaching and testing of gases the leachate for total nitrogen and for some nitrogen-containing species. Several types of tests were performed by the Dravo Lime Company. Particle size and shape of the solids were determined. Elemental analyses were performed using x-ray fluorescence, and moisture and residual EDTA were determined. Tests were conducted to determine if the waste solids could be stabilized using current treatment technology for stabilizing flue-gas desulfurization (FGD) solids. Tests of stabilization were conducted with addition of various amounts of fly ash and lime. Results showed the solids were easily stabilized. The US EPA Toxicity Characteristic Leaching Procedure (TCLP) and toxicity tests using

Daphnia simplex and fat-head minnows were performed on solids both before and after stabilization. The TCLP results after stabilization were well within acceptable limits for heavy metals.

73 (DOE/PC/81004–T4) **Proof-of-concept testing of fluidized-bed copper oxide process: Phase 4, Conceptual design and economic evaluation: Technical progress report No. 4-2, October 1991–March 1992.** Gala, H.B. UOP, Inc., Des Plaines, IL (United States). [1992]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-85PC81004. Order Number DE92041292. Source: OSTI; NTIS; GPO Dep.

The objective of Phase IV of the contract is to design a conceptual flue gas treating unit based on the fluidized-bed copper oxide (FBCO) process for a new coal-fired 500 MW(e) power plant. A technical and economic evaluation of the FBCO process that is based on the conceptual design will also be completed. The scope of the work during this reporting period was limited to Task 4.0, Proposal review and negotiations, and Task 4.1, Definition of design basis. In the revised Statement of Work (SO/At) for Phase IV, a cold-circulation dense-phase testing of the sorbent material is proposed. Presently, UOP does not manufacture the sorbents, SOX-3 and SOX-4, that were used in the life-cycle testing of the fluidized-bed copper oxide unit at PETC. So as an alternative to the sorbent, UOP proposed that the alumina support be used in the cold-circulation tests. Under Task 4.1, the feasibility of using the support material was evaluated in a series of attrition tests conducted on the SOX-3 sorbent and the alumina support. The testing took place during this reporting period. The objective of these tests was to examine the relative strength of the two materials.

0109 Environmental Aspects

Refer also to citation(s) 41

74 (DOE/PC/91334–T97) **High temperature corrosion during use of chlorine: Technical report, March 1, 1992–May 31, 1992.** McNallan, M. (Illinois Univ., Chicago, IL (United States)); Danyluk, S.; Indacochea, J.E. Illinois Dept. of Energy and Natural Resources, Springfield, IL (United States). [1992]. 38p. Sponsored by USDOE, Washington, DC (United States); Illinois Dept. of Energy and Natural Resources, Springfield, IL (United States). DOE Contract FG22-91PC91334. Order Number DE93000945. Source: OSTI; NTIS; GPO Dep.

The goal of this project is to characterize the role of chlorine in coal on the high temperature corrosion processes which can occur in coal combustion and conversion processes. The experience include laboratory tests performed in well-controlled high temperature environments and field tests in industrial coal fired boilers. Evaluation of samples of boiler tubes which have been recovered from boilers which used both high and low chlorine coals does not indicate that the higher chlorine levels are associated with accelerated corrosion of either water wall tubes or superheater tubes in pulverized coal boilers. Laboratory testing of metal coupons in combustion gas environments produced from low sulfur, high chlorine coal IBC-109 and high sulfur-low chlorine coal IBC-101 has been performed at 700 and 800°C. Initial results indicate that more overall corrosion is produced in the high sulfur environment than in the high chlorine environment. Internal attack in the highly alloyed metals alloy 800 and 310 stainless steel is accelerated by the presence of chlorine in the environment, but the level of chlorine required to produce this attack has not yet been determined. Further testing at other temperatures and gas compositions is in progress.

0110 Reserves, Geology, and Exploration

75 (GTK-TURVE–217) **The peat resources of Iitti and their potential use.** Maekilae, M.; Grundstroem, A. Geological Survey of Finland, Espoo (Finland). 1988. 103p. (In Finnish). Order Number DE93721515. Source: OSTI; NTIS.

Geological Survey of Finland investigated the quantity and quality of the industrially exploitable peatlands in the municipality of Iitti, southeastern Finland, during 1964, 1981 and 1985. Altogether 1708 hectares of peatland were studied. This area covers 2.9 % of the land area. The total peatland area suitable for fuel peat production is 669 hectares. Useful peat resources are 13.91 million m^3 in situ. The energy content equals to 5.76 million MWh as calculated for 50 % moisture content. The area suitable for horticultural peat production is 439 hectares, containing about 6.45 million m^3 of peat in situ. The average depth of peat deposits is 2.32 m, including 1.03 m of slightly humified surfical layer. The total amount of peat of the studied peatlands is 39.7 million m^3. Area deeper than 2 m contains 32.1 million m^3 or 81 % of the total reserves including 17.3 million m^3 of better humified peat. 67 % of the peat layers are composed of Sphagnum, 32 % Carex and the rest Bryales peat. The average net calorific value of dry peat is 20.6 MJ/kg and 9.1 MJ/kg when calculated for 50 % moisture content. The average dry bulk density of the samples is 75 kg/m^3 in situ, moisture content 52.8 % of wet weight, pH-value 4.4, ash content 2.4 % and sulphur content 0.15 % on dry bases.

0120 Mining

Refer also to citation(s) 10, 11, 12, 13, 14, 15, 16, 17, 70, 96, 357

76 (DOE/CE/15307–T1) **A waterjet mining machine for use in room and pillar mining operations: [Final report].** Summers, D.A. Missouri Univ., Rolla, MO (United States). High Pressure Waterjet Lab. Jun 1990. 59p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG01-87CE15307. Order Number DE93002802. Source: OSTI; NTIS; GPO Dep.

A new mining machine is constructed for use in room and pillar mining operations. This machine uses the action of computer controlled, centrally located high pressure cutting lances to cut deep slots in a coal face. These slots stress relieve the coal ahead of the machine and outline blocks of coal. The movement forward of the machine then wedges up the lower block of coal. This wedging action is assisted by the gathering arms of the loader section of the machine, and by underlying oscillating waterjets which create a slot ahead of the loading wedge as it advances. Finally the top section of coal is brought down by the sequential advance of wedge faced roof support members, again assisted by the waterjet action from the central cutting arms. The machine is designed to overcome major disadvantages of existing room and pillar mining machines in regard to a reduction in respirable dust, the creation of an immediate roof support, and an increase in product size, with concomitant reduction in cleaning costs.

77 (ETDE/JP-mf–93723855) **Handbook for coal mine safety maintenance techniques. 7.: Control of underground environments.** Coal Mining Research Centre, Tokyo (Japan). Mar 1992 74p. (In Japanese). Order Number DE93723855. Source: OSTI; NTIS.

This is a report on controlling coal mine environments published as a part of the mine safety maintenance technique survey commissioned from the Ministry of International Trade and Industry in the fiscal year 1991. This volume discusses dust control and noise, and describes the latest experimental data and the current status of technical responses ranging from techniques of measuring dust concentration and noise to the control of measures therefor. Methods for dust control at sites, for example, may include coal wall water injection to wet a coal bed, water injected blasting with water injected into dynamite holes, hydraulic mining using high-pressure injection, or a suction-jet aeration system, all to prevent primarily dust generation. The method further calls for suppressing scattering and floating of dust using aeration and water spraying, and wearing dust preventive face masks during works subjected to temporary dust generation. Educating workers on dust has been legislated, and carried out in great detail. Controlling the work hours, work density, and performing health check-ups are also important measures. 30refs., 69 figs., 9 tabs.

78 (ETDE/JP-mf–93723856) **Handbook for coal mine safety maintenance techniques. 8.: Underground monitoring system.** Coal Mining Research Centre, Tokyo (Japan). Mar 1992 126p. (In Japanese). Order Number DE93723856. Source: OSTI; NTIS.

This is a report on coal mine safety maintenance techniques published as a part of the mine safety maintenance technique survey commissioned from the Ministry of International Trade and Industry in the fiscal year 1991. This volume relates to an

underground monitoring system, and describes the process of introduction, purpose and functions of the system in Chapter 1; the way a centralized monitoring system should specifically be in Chapter 2; and thereafter in each chapter the system of controlling mine entering workers, the information transmission method, the current status of the monitoring systems, and examples of the system implementation in different mines. Speaking of the centralized underground monitoring system, varieties of monitoring are performed from measuring and monitoring temperatures, quantity of air flow, gas and spring water amounts to operating conditions of face and other major facilities. Real-time remote centralized monitoring, measurement, and control are also carried out using freely such advanced technologies as using computers, industrial TV, and optical communications including out-of-tunnel devices such as belt conveyers. Not only data can be collected and stored, but also inductive radio transmission enables simultaneous conversations among all the points in a tunnel. 110 figs., 18 tabs.

79 (OY/PSTL-TIED–79) **Technological processes of field drying in optimum production of peat.** Fagan, H. Oulu Univ. (Finland). Research Inst. of Northern Finland. Dec 1991. 55p. Order Number DE93721622. Source: OSTI; NTIS.

Research projects are afoot in Finland, the USSR and elsewhere into the technological process of field drying in the optimum production of peat. For example, in Finland, there is presently the Optimiturve program which incorporates the efforts of the Technical Research Centre of Finland (VTT), the Research Institute of Northern Finland, Vapo Oy, etc. The optimum control and production of peat under field conditions is a diverse and complex are of study. It draws upon the experimental and theoretical studies of peat drying, production control and management, introduction and testing of new technological equipment and operations research, etc. To date solar drying of peat in bulk has proven to be the most economically feasible means of peat drying. Such drying is controlled by meteorological and technical factors. Meteorological factors are unalterable and have to be adjusted to accordingly. The technological factors are variable and allows for a measure of control. Henceforth, this report strives to combine the aforementioned knowledge in order to better regulate the peat production cycle. This process leads in the long run to an economic payoff. This report might be expedient in Finland, where researchers have stated that the output of milled peat falls far short of actual potential.

0130 Transport, Handling, and Storage

Refer also to citation(s) 1239

80 (CONF-9110369–, pp. 4-33) **On the stability in a 2D Hagen-Poiseuille resuspension flow.** Zhang, K. (City Univ. of New York, New York (United States)); Acrivos, A.; Schaflinger, U. USDOE Pittsburgh Energy Technology Center, PA (United States); National Science Foundation, Washington, DC (United States). [1991]. DOE Contract FG02-90ER14139. From 3. Joint Department of Energy/National Science Foundation (DOE/NSF) workshop on flow of particulates and fluids; Worcester, MA (United States); 22-24 Oct 1991. In *Joint DOE/NSF workshop on flow of particulates and fluids. Proceedings.* 396p. Order Number DE92012692. Source: OSTI; NTIS.

A linear stability analysis of a viscous resuspension flow, which develops from an initially well mixed suspension flowing along a two-dimensional channel, is described. The analysis is based on a two-fluid model in which the non-uniformity of the particle concentration distribution within the suspended layer is ignored. Numerical solutions to the relevant Orr-Sommerfeld equations for both temporal and spatial disturbance modes are obtained for the special case of a suspension of spherical particles in water and flowing in a duct having a vertical spacing of 2cm. It is found that the resuspension flow is convectively unstable and that the largest amplification occurs in the range of moderate stability Reynolds numbers. It is also shown that a reduction in the particle concentration in the feed suspension and/or an increase in the relative density ratio of the solid particles to that of the suspending fluid will enhance the instability of the interfacial mode.

0140 Combustion

Refer also to citation(s) 18, 62, 425, 427, 1041, 2420

81 (ANL/CP–76147) **Present state-of-the-art of two-phase flow model calculations.** Lyczkowski, R.W.; Ding, Jianmin; Bouillard, J.X. Argonne National Lab., IL (United States). Jul 1992. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9209160–10: International symposium on energy, environment and information management, Argonne, IL (United States), 15-18 Sep 1992). Order Number DE92041124. Source: OSTI; NTIS; GPO Dep.

Argonne National Laboratory (ANL) has developed two- and three-dimensional computer programs to predict hydrodynamics in complex fluid/solids systems including atmospheric and pressurized bubbling and circulating fluidized-bed combustors and gasifiers, concentrated suspension (slurry) piping systems and advanced particle-bed reactors for space-based applications, for example. The computer programs are based upon phenomenological mechanistic models and can predict frequency of bubble formation, bubble size and growth, bubble frequency and rise-velocity, solids volume fraction, gas and solids velocities and low dimension chaotic attracters. The results of these hydrodynamic calculations are used as inputs to mechanistic models to predict heat transfer and erosion and have been used to produce simplified models and guidelines to assist in design and scaling. An extensive coordinated effort involving industry, government, and university laboratory data has served to validate the various models. Babcock & Wilcox (B&W), in close collaboration with ANL, has developed the three dimensional FORCE2 computer program which is both transient as well as steady-state.

82 (DOE/MC/24207–2996) **Fundamental study on transient bubble (slug) behavior by characterizing transient forces of solid particles in fluidized beds: 1990 Annual report.** Kono, H.O. West Virginia Univ., Morgantown, WV (United States). Dept. of Chemical Engineering. Jan 1991. 119p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC21-87MC24207. Order Number DE91002077. Source: OSTI; NTIS; GPO Dep.

The objective of this work is to recognize and interpret the signals of transient motion of bubbles (slugs) in fluidized beds by measuring and utilizing the signals of transient motion of solid particles. The two signals were measured simultaneously and also synchronized by using the TTL signal technique in the same fluidized beds. Also, a simultaneous study of video bubble image, transient force and pressure signals was initiated in a two dimensional fluidized bed. we successfully synchronized three signals so that the relationship of bubble behavior and force pressure signals can be identified and characterized. It has been found that bubble image can well be correlated to the transient force signai of solid particles under certain conditions in three dimensional fluidized beds. Accordingly, it seems that the transient force signals can significantly help understanding the transient motion of bubbles (slugs), which is important to design the fluidized beds.

83 (DOE/MC/24216–3122) **Atmospheric fluidized bed combustion advanced concept system: Final report.** Donlee Technologies, Inc., York, PA (United States). May 1992. 205p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC21-87MC24216. Order Number DE93000202. Source: OSTI; NTIS; GPO Dep.

DONLEE Technologies Inc. is developing with support of the US Department of Energy an advanced circulating fluidized bed technology known as the Vortex™ Fluidized Bed Combustor (VFBC). The unique feature of the VFBC is the injection of a significant portion of the combustion air into the cyclone. Since as much as one-half of the total combustion air is injected into the cyclone, the cross-sectional area of the circulating fluidized bed is considerably smaller than typical circulating fluidized beds. The technology is being developed for two applications: Industrial-scale boilers ranging from 20,000 to 100,000 pounds per hour steam generating capacity; and two-stage combustion in which a substoichiometric Vortex Fluidized Bed Combustor (2VFBC) or precombustor is used to generate a combustible gas for use primarily in boiler retrofit applications. This Level II analysis of these two applications indicates that both have merit. An industrial-scale VFBC boiler (60,000 lb/hr

of steam) is projected to be economically attractive with coal prices as high as $40 per ton and gas prices between $4 and $5 per thousand cubic feet. The payback time is between 3 and 4 years. The 2VFBC system was evaluated at three capacities of application: 20,000; 60,000 and 100,000 lb/hr of steam. The payback times for these three capacities are 4.5, 2.1 and 1.55 years, respectively. The 2VFBC has potential applications for retrofit of existing pulverized coal-fired boilers or as a new large (utility) boiler. Pressurized operation of the 2VFBC has considerable potential for combined cycle power generation applications. Experimental development of both applications is presented here to demonstrate the potential of these two technologies.

84 (DOE/PC/89769–T12) **Predictive models of circulating fluidized bed combustors: 12th technical progress report.** Gidaspow, D. Illinois Inst. of Tech., Chicago, IL (United States). Dept. of Chemical Engineering. Jul 1992. 44p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-89PC89769. Order Number DE93000938. Source: OSTI; NTIS; GPO Dep.

Steady flows influenced by walls cannot be described by inviscid models. Flows in circulating fluidized beds have significant wall effects. Particles in the form of clusters or layers can be seen to run down the walls. Hence modeling of circulating fluidized beds (CFB) without a viscosity is not possible. However, in interpreting Equations (8-1) and (8-2) it must be kept in mind that CFB or most other two phase flows are never in a true steady state. Then the viscosity in Equations (8-1) and (8-2) may not be the true fluid viscosity to be discussed next, but an Eddy type viscosity caused by two phase flow oscillations usually referred to as turbulence. In view of the transient nature of two-phase flow, the drag and the boundary layer thickness may not be proportional to the square root of the intrinsic viscosity but depend upon it to a much smaller extent. As another example, liquid-solid flow and settling of colloidal particles in a lamella electrosettler the settling process is only moderately affected by viscosity. Inviscid flow with settling is a good first approximation to this electric field driven process. The physical meaning of the particulate phase viscosity is described in detail in the chapter on kinetic theory. Here the conventional derivation resented in single phase fluid mechanics is generalized to multiphase flow.

85 (DOE/PC/90169–T5) **Coal desulfurization in a rotary kiln combustor: Quarterly report No. 1, April 16, 1990–July 15, 1990.** Cobb, J.T. Jr. BCR National Lab., Pittsburgh, PA (United States). 15 Aug 1990. 108p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-90PC90169. Order Number DE92041280. Source: OSTI; NTIS; GPO Dep.

BCR National Laboratory (BCRNL) has initiated a project aimed at evaluating the technical and economic feasibility of using a rotary kiln, suitably modified, to burn Pennsylvania anthracite wastes, co-fired with high-sulfur bituminous coal. Limestone will be injected into the kiln for sulfur control, to determine whether high sulfur capture levels can be achieved with high sorbent utilization. The principal objectives of this work are: (1) to prove the feasibility of burning anthracite refuse, with co-firing of high-sulfur bituminous coal and with limestone injection for sulfur emissions control, in a rotary kiln fitted with a Universal Energy International (UEI) air injector system; (2) to determine the emissions levels of SO_x and NO_x and specifically to identify the Ca/S ratios that are required to meet New Source Performance Standards; (3) to evaluate the technical and economic merits of a commercial rotary kiln combustor in comparison to fluidized bed combustors; and, (4) to ascertain the need for further work, including additional combustion tests, prior to commercial application, and to recommend accordingly a detailed program towards this end.

86 (DOE/PC/90310–T7) **Combustion of dense streams of coal particles: Quarterly progress report No. 7, February 29, 1991–May 28, 1992.** Annamalai, K. Texas A and M Univ., College Station, TX (United States). Dept. of Mechanical Engineering. 17 Jul 1992. 46p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-90PC90310. Order Number DE92040773. Source: OSTI; NTIS; GPO Dep.

Part III of the report contains the modeling results on a cylindrical cloud of char particles. It shows a monotonic increase in ignition time with increased cloud denseness which is in contrast with a minimum in ignition time for coal clouds. It is interesting to note that clouds remain essentially at uniform and hence a plot was made on cloud burn rate vs 1/T where T is temperature of any particle inside the cloud in order to determine the zones of reactions (Fig. 8 of Part III) i.e., cylindrical cloud is analogous to a large porous cylinder. As expected at low temperatures the plot is linear. However the denser cloud reaches diffusion controlled combustion somewhat at lower temperatures than a dilute cloud due to oxygen deficiency. These results are reported in Part II of our review article.

87 (DOE/PC/91161–T1) **The development of a coal-fired combustion system for industrial process heating applications: Quarterly technical progress report, January 1992–March 1992.** Vortec Corp., Collegeville, PA (United States). 16 Jul 1992. 44p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-91PC91161. Order Number DE93000306. Source: OSTI; NTIS; GPO Dep.

PETC has implemented a number of advanced combustion research projects that will lead to the establishment of a broad, commercially acceptable engineering data base for the advancement of coal as the fuel of choice for boilers, furnaces, and process heaters. Vortec Corporation's Coal-Fired Combustion System for Industrial Process Heating Applications has been selected for Phase III development under contract DE-AC22-91PC91161. This advanced combustion system research program is for the development of innovative coal-fired process heaters which can be used for high temperature melting, smelting, recycling, and refining processes. The process heater concepts to be developed are based on advanced glass melting and ore smelting furnaces developed and patented by Vortec Corporation. The process heater systems to be developed have multiple use applications; however, the Phase HI research effort is being focused on the development of a process heater system to be used for producing glass frits and wool fiber from boiler and incinerator ashes. The primary objective of the Phase III project is to develop and integrate all the system components, from fuel through total system controls, and then test the complete system in order to evaluate its potential marketability. The economic evaluation of commercial scale CMS processes has begun. In order to accurately estimate the cost of the primary process vessels, preliminary designs for 25, 50, and 100 ton/day systems have been started under Task 1. This data will serve as input data for life cycle cost analysis performed as part of techno-economic evaluations. The economic evaluations of commercial CMS systems will be an integral part of the commercialization plan.

88 (DOE/PC/91334–T76) **Combustion characterization of the blend of plant coal and recovered coal fines: [Quarterly] technical report, March 1, 1992–May 31, 1992.** Singh, S. (SS Energy Environmental International, Inc., Rockford, IL (United States)); Scaroni, A.; Miller, B.; Choudhry, V. SS Energy Environmental International, Inc., Rockford, IL (United States). [1992]. 15p. Sponsored by USDOE, Washington, DC (United States); Illinois Dept. of Energy and Natural Resources, Springfield, IL (United States). DOE Contract FG22-91PC91334. Order Number DE93000525. Source: OSTI; NTIS; GPO Dep.

The overall objective of this proposed research program is to determine the combustion characteristics of the blend derived from mixing a plant coal and recovered and clean coal fines from the pond. One plant coal and three blend samples will be prepared and utilized. The blend samples will be of a mixture of 90% plant coal + 10% fines, 85% plant coal + 15% fines, 80% plant coal + 20% fines having particle size distribution of 70% passing through -200 mesh size. These samples' combustion behavior will be examined in two different furnaces at Penn State University, i.e., a down-fired furnace and a drop-tube furnace. The down-fired furnace win be used mainly to measure the emissions and ash deposition study, while the drop tube furnace will be used to determine burning profile, combustion efficiency, etc. The burning profile of the plant coal and the three blends was determined in a thermogravimetric analyzer. Results indicated slower burning of the blends due to low volatile matter and oxidized coal particles. Ash fusing temperatures of the samples were determined using ASTM procedure. Preliminary combustion evaluation of the samples

(100% plant coal, 80% plant coal/20% recovered coal fines) indicated that the flame was stable at 100,000-200,000 Btu/hr firing rate. Carbon conversion efficiency of 85 to 90% was recorded using the Ash Tracer technique. Tests are continuing to determine the operating boundaries for these blends while measuring the emissions of SO_x, NO_x, CO and O_2, maintaining a stable flame.

89 (DOE/PC/91334–T78) **Cooperative research on the combustion characteristics of cofired desulfurized Illinois coal and char with natural gas: [Quarterly] technical report, March 1, 1992–May 31, 1992.** Buckius, R.O.; Wu, Cheng-Kang; Krier, H.; Peters, J.E. Illinois Univ., Urbana, IL (United States). [1992]. 20p. Sponsored by USDOE, Washington, DC (United States); Illinois Dept. of Energy and Natural Resources, Springfield, IL (United States). DOE Contract FG22-91PC91334. Order Number DE93000527. Source: OSTI; NTIS; GPO Dep.

The DTFF was modified to extend the operating range to larger sample collection capabilities and higher temperatures. A plasma gas heater was designed and constructed so that temperatures and heating rates encountered by pulverized coal particles in the flames of large boilers or in the advanced slogging combustors are better simulated. The modified DTFF, referred to as the Ash Characterization Facility, has been set up and initial tests with ash collection and analysis have been performed. The plasma torch has been tested, and steady operation has been established. The Ash Characterization Facility has been used to produce ash samples from IBC 106 coal at several temperatures and residence times. The total sulfur in the ash samples has been determined, showing the contributions of methane coming for operating parameters. A long sampling probe has been constructed, which win enable ash and char samples to be obtained at various residence times. Preparatory work with the gas chromatograph has been initiated to permit the simultaneous analysis of both the gas phase with the solid particle.

90 (DOE/PC/91334–T79) **Combustion of Illinois coals and chars with natural gas: [Quarterly] technical report, March 1, 1992–May 31, 1992.** Buckius, R.O.; Peters, J.E.; Krier, H. Illinois Univ., Urbana, IL (United States). [1992]. 24p. Sponsored by USDOE, Washington, DC (United States); Illinois Dept. of Energy and Natural Resources, Springfield, IL (United States). DOE Contract FG22-91PC91334. Order Number DE93000528. Source: OSTI; NTIS; GPO Dep.

Combined combustion of coal and natural gas offers advantages compared to burning coal or natural gas alone. For example, low volatile coals or low volatile chars derived from treatment or gasification processes can be of limited use due to their poor flammability characteristics. However, the use of natural gas in conjunction with the solid fuel can provide the necessary "volatiles" to enhance the combustion. Additionally, natural gas provides a clean cofiring fuel source which can enhance the usefulness of coals with high sulfur content. Addition of natural gas may reduce SO_x emissions through increased sulfur retention in the ash and reduce NO_x emissions by varying local stoichiometry and temperature levels. This research program seeks to clarify the contributions and to identify the controlling mechanisms of coining natural gas with Illinois coal through studies of particle ignition, burning rates and ash characterization. The first two quarters focused on the ignition delay measurements and their analysis, along with the incorporation of particle porosity into the burning rate model. The emphasis of the third quarter was on a more detailed understanding of the burning rate process, as well as understanding of cofiring's effects on sulfur retention. The contributions of particle burning area to the quantification of the particle burning mechanisms have been shown to be important and continue to be investigated. Ash samples for various methane concentrations under similar other conditions have shown positive trends in reducing $S0_2$ emission through increased sulfur capture in the ash.

91 (DOE/PC/91334–T80) **Behavior of sulfur and chlorine in coal during combustion and boiler corrosion: [Quarterly] technical report, March 1, 1992–May 31, 1992.** Chou, C.L. (Illinois State Geological Survey, Champaign, IL (United States)); Hackley, K.C.; Donnals, G.L.; Cao, J.; Ruch, R.R.; Pan, W.P.; Shao, D. Illinois State Geological Survey, Champaign, IL (United States). [1992]. 24p. Sponsored by USDOE, Washington, DC (United States); Illinois Dept. of Energy and Natural Resources, Springfield, IL (United States). DOE Contract FG22-91PC91334. Order Number DE93000529. Source: OSTI; NTIS; GPO Dep.

Four replicate experiments of pyrolysis with quadrupole gas analyzer and ion selective electrode were conducted to monitor the release of chlorine and sulfur from a high-chlorine Illinois coal IBC-109 (0.42% chlorine on dry basis). The chlorine in coal is released solely as HCl, and the HCl release profile shows a broad peak between 250°C and 600°C with a maximum at 445°C. In contrast, the sulfur release profile shows three peaks; the sulfur released around 370°C may be derived from a labile (possibly aliphatic) component of organic sulfur, the main peak at 475°C corresponds to the release of the main component (thiophenic) of organic sulfur, and the third peak at 600° results from the decomposition of pyrite. Sulfur dioxide (SO_2) is the major sulfur species under an oxidizing condition in the combustion gas; additional gaseous sulfur species (COS and H_2S) are observed when the atmosphere is changed to a reducing condition. Sodium and chlorine contents in char residues determined by neutron activation analysis showed that 98% of chlorine in coal was volatilized during pyrolysis to 800°C, and all the sodium is retained in the chars. The thermogravimetry-Fourier transform infrared (FTIR) spectroscopy experiments were carried out to characterize gaseous species during pyrolysis of four Illinois coals (IBC-103, -105, -106, and -109). Gas evolution profiles of sulfur (H_2S, $S0_2$, and COS), chlorine (HCl), and nitrogen (NH_3 and HCN) species were determined. Similar release profiles of HCl and NH_3 supported an interpretation that chlorine and nitrogen are closely associated in coal. COS may be formed by reaction of CO with H_2S in the gas phase.

92 (DOE/PC/91334–T96) **CFBC evaluation of fuels processed from Illinois coals: Technical report, March 1, 1992–May 31, 1992.** Rajan, S. (Southern Illinois Univ., Carbondale, IL (United States). Dept. of Mechanical Engineering and Energy Processes). Illinois State Geological Survey, Champaign, IL (United States). [1992]. 23p. Sponsored by USDOE, Washington, DC (United States); Illinois Dept. of Energy and Natural Resources, Springfield, IL (United States). DOE Contract FG22-91PC91334. Order Number DE93000947. Source: OSTI; NTIS; GPO Dep.

The combustion and emissions properties of (a) flotation slurry fuel beneficiated from coal fines at various stages of the cleaning process and (b) coal-sorbent pellets made from the flotation concentrate of the same beneficiation process using corn starch as binder is being investigated in a 4-inch internal diameter circulating fluidized bed combustor (CFBC). Combustion data such as SO_2, NO_x emissions, combustion efficiency and ash mineral matter analyses from these fuels are compared with similar parameters from a reference coal burnt in the same fluidized bed combustor. In the last quarter, the CFBC was brought on line and tests were performed on standard coal No. 3 from the Illinois Basin Coal Sample Program (IBCSP). During this quarter, it was decided, that a more meaningful comparison could be obtained if, instead of using the IBCSP No. 3 coal as a standard, the run-of-mine Illinois No. 5 coal from the Kerr-McGee Galatia plant could be used as the reference coal for purposes of comparing the combustion and emissions performance, since the slurry and pellet fuels mentioned in (a) and (b) above were processed from fines recovered form this same Illinois No. 5 seam coal. Accordingly, run-of-the mine Illinois No. 5 coal from the Galatia plant were obtained, riffled and sieved to −14+18 size for the combustion tests. Preliminary combustion tests have been made in the CFBC with this new coal. In preparation for the slurry tests, the moisture content of the beneficiated slurry samples was determined. Proximate and ultimate analyses of all the coal samples were performed. Using a Leeds and Northrup Model 7995-10 Microtrek particle size analyzer, the size distributions of the coal in the three slurry samples were determined. The mineral matter content of the coal in the three slurry samples and the Illinois No. 5 seam coal were investigated using energy dispersive x-ray analysis.

93 (DOE/PC/91334–T98) **The use of FBC wastes in the reclamation of coal slurry solids: Technical report, March 1, 1992–May 31, 1992.** Dreher, G.B. (Illinois State Geological Survey, Champaign, IL (United States)); Roy, W.R.; Steele, J.D. Illinois Dept. of Energy and Natural Resources, Springfield, IL (United

States). [1992]. 19p. Sponsored by USDOE, Washington, DC (United States); Illinois Dept. of Energy and Natural Resources, Springfield, IL (United States). DOE Contract FG22-91PC91334. Order Number DE93000944. Source: OSTI; NTIS; GPO Dep.

Fluidized bed combustion (FBC) is a relatively new technology that is used commercially for the combustion of coal. In Illinois, this technology is valuable because it allows the combustion of Illinois high sulfur coal without pollution of the atmosphere with vast quantities of sulfur oxides. In FBC, coal is mixed with limestone or dolomite either before injection into the combustion chamber or in the combustion chamber. As the coal burns, sulfur in the coal is oxidized to SO_2 and this is trapped by reaction with the limestone or dolomite to form gypsum ($CaSO_4 \cdot 2H_2O$). Solid by-products from FBC are generally a mixture of calcium oxide, gypsum, coal ash, and unburned coal. The present research project is designed to provide initial data on one possible use of FBC waste. FBC wastes from five different locations in Illinois are mixed with coal slurry solids (CSS) from two different coal preparation plants at Illinois coal mines. In mixtures of FBC waste and coal slurry solids, the alkaline components of the FBC waste are expected to react with acid produced by the oxidation of pyrite in the coal slurry solid. An objective of this research is to determine the chemical composition of aqueous leachates from mixtures of FBC wastes, generated under various operating conditions, and the coal slurry solids. These data will be used in future research into the ability of such mixtures to support seed germination and plant growth. The final goal of this and future research is to determine whether mixed FBC waste and coal slurry solids can be used as a satisfactory growing medium in slurry pond reclamation. The chemical analyses of the 8 starting solids (5 FBC wastes, 2 Css samples, and 1 agricultural limestone sample) were completed.

94 (DOE/PC/91334–T100) **Evaluation and utilization of Illinois FBC residues for construction materials: Technical progress report, March 1, 1992–May 31, 1992.** Ghafoori, N. (Southern Illinois Univ., Carbondale, IL (United States). Dept. of Civil Engineering and Mechanics); Sami, S. Illinois Dept. of Energy and Natural Resources, Springfield, IL (United States). [1992]. 17p. Sponsored by USDOE, Washington, DC (United States); Illinois Dept. of Energy and Natural Resources, Springfield, IL (United States). DOE Contract FG22-91PC91334. Order Number DE93000942. Source: OSTI; NTIS; GPO Dep.

The overall objective of this program is to investigate the extent to which fluidized bed combustion (FBC) by-products can be properly utilized as viable construction materials. This investigation focuses primarily on the properties of residues derived from fluidized combustion burning of Illinois high-sulfur coal. The research plan calls for evaluation of physics-chemical and engineering characteristics of the FBC-based cement and non-cement mixes. The results of this study will be used to compare the physical and mechanical properties of the FBC-based mixtures with those of conventional mixes. The suitability of using FBC residues as a filler or binder aggregate for Portland cement-based mixtures and Non-Portland cement mixes in the form of conventional and roller compacted materials will be evaluated. During this reporting period, physics-chemical properties of class F fly ash, supplied by the American Fly Ash Company of Naperville, Illinois, were completed. Work on all major tasks, sulfate durability of FBC cement-based mixtures and Engineering characteristics of roller compacted non-cement FBC mixes (task II), are on-going.

0150 Economic, Industrial, and Business Aspects

Refer also to citation(s) 794, 799

95 (NEDO-P–9112) **Estimation of coal usage technologies in relation to CO_2 for global environment. (3).** New Energy and Industrial Technology Development Organization, Tokyo (Japan). Mar 1992. 126p. (In Japanese). Sponsored by New Energy and Industrial Technology Development Organization, Tokyo (Japan). Order Number DE93723964. Source: OSTI; NTIS.

The paper conducts a research on a future trend of development of CO_2 emission reduction technology in the main industries and states its future prospect. It also proposes the future state of coal utilization technology based on the results of the research. CO_2 emission is predicted by a long-term energy supply/demand outlook, and the future energy system technology and energy conservation measures are mentioned. Future technologies are described relating to CO_2 reduction measures in such main coal utilization industries as electric utility, iron and steel, cement, petroleum, town gas and chemical industry. As one of the technologies to treat CO_2 emitted from each industry, underground injection/fixation method is studied in terms of its economic efficiency. Coal gasification/liquefaction and coal combustion technologies are taken up as long-term coal utilization technologies, and the future state of development of the coal utilization technology in the global environment is proposed. 92 refs., 68 figs., 44 tabs.

0160 Health and Safety

96 (ETDE/JP-mf–93723857) **Handbook for coal mine safety maintenance techniques. 9.: Safety maintaining technology.** Coal Mining Research Centre, Tokyo (Japan). Mar 1992 108p. (In Japanese). Order Number DE93723857. Source: OSTI; NTIS.

This is a report on coal mine safety maintenance techniques published as a part of the mine safety maintenance technique survey commissioned from the Ministry of International Trade and Industry in the fiscal year 1991. This volume describes on five areas, i.e., general safety control, undersea coal mine safety control, coal mine waste water safety control, administrative policies on safety maintenance and assisting systems, and safety maintenance statistics. The general safety control for example ranges from personal control system and mechanism to functions of the Safety Section, items requiring executives' approvals, education, and to safety control systems using devices, as shown in the presented examples of safety control in normal conditions used in representative coal mines. Then, the report describes on safety control at emergencies as to first aid facilities, life saving devices, evacuation systems, and trainings. Mines are characterized largely by the elements of "nature" in addition to man and machine elements, which increase difficulty in identifyihg and monitoring properties and characteristics of the elements, as well as labor intensiveness. Inasmuch as, safety control systems operated by people, and roles of operating persons are very important. 16 refs., 37 figs., 12 tabs.

02 PETROLEUM

0202 Reserves, Geology, and Exploration

Refer also to citation(s) 110, 1775, 1776, 1779, 1780

97 (DOE/BC/14403–3) **Characterization of oil and gas reservoir heterogeneity: Final report.** Tyler, N.; Barton, M.D.; Bebout, D.G.; Fisher, R.S.; Grigsby, J.D.; Guevara, E.; Holtz, M.; Kerans, C.; Nance, H.S.; Levey, R.A. Texas Univ., Austin, TX (United States). Bureau of Economic Geology. Oct 1992. 219p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-89BC14403. Order Number DE92001072. Source: OSTI; NTIS; GPO Dep.

Research described In this report addresses the internal architecture of two specific reservoir types: restricted-platform carbonates and fluvial-deltaic sandstones. Together, these two reservoir types contain more than two-thirds of the unrecovered mobile oil remaining ill Texas. The approach followed in this study was to develop a strong understanding of the styles of heterogeneity of these reservoir types based on a detailed outcrop description and a translation of these findings into optimized recovery strategies in select subsurface analogs. Research targeted Grayburg Formation restricted-platform carbonate outcrops along the Algerita Escarpment and In Stone Canyon In southeastern New Mexico and Ferron deltaic sandstones in central Utah as analogs for the North Foster (Grayburg) and Lake Creek (Wilcox) units, respectively. In both settings, sequence-stratigraphic style profoundly influenced between-well architectural fabric and permeability structure. It is concluded that reservoirs of different depositional origins can therefore be categorized Into a "heterogeneity matrix" based on varying intensity of vertical and lateral heterogeneity. The utility of the matrix is that it allows prediction of the nature and location

of remaining mobile oil. Highly stratified reservoirs such as the Grayburg, for example, will contain a large proportion of vertically bypassed oil; thus, an appropriate recovery strategy will be waterflood optimization and profile modification. Laterally heterogeneous reservoirs such as deltaic distributary systems would benefit from targeted infill drilling (possibly with horizontal wells) and improved areal sweep efficiency. Potential for advanced recovery of remaining mobile oil through heterogeneity-based advanced secondary recovery strategies in Texas is projected to be an incremental 16 Bbbl. In the Lower 48 States this target may be as much as 45 Bbbl at low to moderate oil prices over the near- to mid-term.

98 (DOE/ID/12839–8) **Characterization of oil and gas reservoir heterogeneity: Technical progress report, April 1, 1992–June 30, 1992.** Sharma, G.D. Alaska Univ., Fairbanks, AK (United States). Petroleum Development Lab. [1992]. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG07-90ID12839. Order Number DE93000517. Source: OSTI; NTIS; GPO Dep.

The ultimate objective of this cooperative research project is to characterize Alaskan petroleum reservoirs in terms of their reserves, physical and chemical properties, geologic configuration in relation to lithofacies and structure, and development potential. The project has two tasks: Task 1 is a geological description of the reservoirs including petrophysical properties, i.e., porosity, permeability, permeability variation, formation depth, temperature, and net pay, facies changes and reservoir structures as drawn from cores, well logs, and other geological data. Task 2 is reservoir fluid characterization-determination of physical properties of reservoir fluids including density, viscosity, phase distributions and composition as well as petrogenesis-source rock identification; and the study of asphaltene precipitation for Alaskan crude oils. Results are discussed.

99 (NEI-DK–977) **Optimization of reflection seismic acquisition parameters.** Westphal Stephesen, M.; Mosegaard, K. Oedegaard og Danneskiold-Samsoee ApS, Copenhagen (Denmark). Aug 1992 159p. Contract EM-1313/88-6. Order Number DE93721456. Source: OSTI; NTIS.

EFP-88.

The analysis of seismic data, is one of the most important sources of information on physical parameters of geological strata. The key to this coded information is a mathematical description of the spread of the seismic waves. Maximum information can, in theory, be gained by the use of an inversion method, but this can only give geological information limited by the nature of the problem and the conditions under which data were acquired. The report tries to give answers to the problems concerning the effect of deviation from ideal conditions, and which data collection parameters give the greatest possible information value of the data content within the practical limits. A simplified, reflection seismic data acquisition problem is investigated with the aim of optimizing the choice of data acquisition parameters. A description is given of the spread of the seismic waves comprising a set of equations for the calculation of wave spread times, wave forms, amplitudes etc which are included in data collection parameters. The goal for the data quality is a figure which is defined in such a way that it grows in accordance with the quality of the geological information found in the data. Data quality indicators are spectral band breadths of data, apertures etc. supplemented by uptake time and sampling frequency. It is hoped that this method will lead to the development of automatic optimization of seismic data collection parameters. The detailed mathematical model of the data generation process is presented and explained and a print of the whole main computerized optimization programme is given. (AB) (93 refs.).

0203 Drilling and Production

Refer also to citation(s) 1670, 2472

100 (DOE/BC/14664–8) **Polysaccharides and bacterial plugging: [Quarterly report], April 1–June 30, 1992.** Fogler, H.S. Michigan Univ., Ann Arbor, MI (United States). [1992]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-90BC14664. Order Number DE92041138. Source: OSTI; NTIS; GPO Dep.

The objectives of this research are to elucidate and model bacterial transport in porous media, to determine the importance of polysaccharides bridging as a retentive mechanism, and to identify key parameters that influence porous media plugging. This project has been subdivided into three tasks: Task 1 is the determination of the growth kinetics of the Leuconostoc bacteria and how they are affected by (1) the nutrient feed, and (2) surface effects; Task 2 will quantify the importance of polysaccharide production as a cell retention mechanism; and Task 3 is the elucidation of the rate of polysaccharide production and the combined effect that polysaccharide production and cell growth has upon plugging. Batch growth experiments have been conducted to determine the rate of cell growth, polymer production and nutrient consumption. The data from these experiments are currently being reduced to aid the development of an overall growth model.

101 (DOE/CE/15482–T8) **The development and testing of a fieldworthy system of improved fluid pumping device and liquid sensor for oil wells: Technical progress report, third quarter 1992.** Buckman, W.G. Buckman (William G.), Bowling Green, KY (United States). 5 Oct 1992. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG01-90CE15482. Order Number DE93000650. Source: OSTI; NTIS; GPO Dep.

An economical gas lift system has been designed that uses the airlift principles of the APOP system to enable one to pump deep wells which have been initially pumped using jack pumps. It can be constructed and installed in oil and/or gas wells where jack pumps have been operating. The 2 in. tubing in the bore hole is left in place and the rods are pulled from the normally 2 in. tubing. A 1 in. or greater diameter tubing containing a one way valve near its bottom and several small holes near the bottom of the 1 in. tube and just above the one way valve is installed into the 2 in. tubing. The one inch tube extends the total length of the 2 in. tubing and is seated on the seating nipple at the bottom of the 2 in. tubing. The space between the concentric tubes can serve as the gas(air) line and the center 1 in. tube serves as the liquid discharge line. This enables this pump to be used in many marginal wells which ordinarily would be uneconomical to pump. This is especially true for deep wells because the cost of jack pumps and the tubing as well as the maintenance to pump liquids from bore holes that are several thousand feet deep is substantial.

102 (DOE/CE/15497–T2) **Design, build, develop, and test a fieldworthy spiral tool and packer for casing repair: Quarterly report, June 16, 1992–September 15, 1992.** Koster, C. Nu-Bore Systems, Wichita Falls, TX (United States). [1992]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG01-91CE15497. Order Number DE93000735. Source: OSTI; NTIS; GPO Dep.

A new method for sealing casing is currently under development by Nu-Bore Systems. The method involves internally lining a section of the wellbore with a multi-layer spiral wrapping of a high strength, corrosion resistant metal interleaved with a high bond strength, resilient epoxy. The high strength metal is preferably a copper based alloy hardened to a very high strength in order to resist the internal and external pressures of downhole environments. The epoxy adhesive formulation is one that forms a bond between the steel inner wall of the casing and copper alloy strip. The copper alloy strip spiral wraps are interleaved with epoxy, and the whole system provides a high level of outward directed spring force and, thus, resists both internal and externally directed forces. This method has been assessed by the Department of Energy, and the magnitude of the oilfield need and the technology are described in a DoE report entitled, "Downhole Casing Repair System" (OERI Number 013152). In this report, the cost savings to the nation's energy program was estimated to be in the range of hundreds of millions of dollars per year, and the method was judged technically feasible once certain well defined engineering obstacles are overcome.

103 (DOE/CE/15553–T1) **System to inject steam and produce oil from the same wellbore through downhole valve switching: First quarterly report.** S-Cal Research Corp., San

Rafael, CA (United States). [1992]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG01-92CE15553. Order Number DE93000914. Source: OSTI; NTIS; GPO Dep.

Various Downhole Equipment systems have been designed for typical applications in three California Oilfields,based on well data gathered from three different Operating Companies. The first system, applicable to a 2,000 ft deep reservoir (Monarch) a highly underpressured, unconsolidated sand of 200 ft net pay, located in the Midway-Sunset field, is based on the use of a new well. The second well configuration considered was the re-entry into an existing well equipped with a 7 inches casing and penetrating into two separate sandstone reservoirs, at normal pressures in the North Antelope Hills field. Only the bottom layer is presently in production through a gravel-packed 5.5 inch linear, while the upper zone is behind the cemented casing. The third case studied was the re-entry into an existing well equipped with an 8 5/8 inch casing, presently unperforated, into a thin under-pressured sand reservoir (Weber) in the Midway-Sunset field. All three California fields contain Heavy Oils of different but relatively high viscosities. A new class of potential applications of our new technology has also been considered: the recovery of Light Oil (> 20 API) by steam injection in under-pressured Carbonate reservoirs which lay at depths beyond the economic limit for conventional steam injection technology. The possibility of including this application in a Field Test proposal to the DOE, under the Class II Oil Program, is now under review by various Operators. A drilling contractor experienced in drilling multiple horizontal wells in Carbonate reservoirs and a team of reservoir engineers experienced in the recovery of Light Oil by steam in fractured reservoirs have expressed their interest in participating in such a joint Field Project. Laboratory tests on specific prototypes of Downhole Sealing Elements are underway.

104 (DOE/ER/75419–T1) **A research agenda for academic petroleum engineering programs: [Final report].** Calhoun, J.C. Jr. Texas A and M Univ., College Station, TX (United States). Texas Engineering Experiment Station. 31 Mar 1990. 124p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-88ER75419. Order Number DE93002880. Source: OSTI; NTIS; GPO Dep.

The development of a research agenda should be a direct way of portraying the scope of petroleum engineering, of identifying the critical technological issues faced by the profession,of elucidating the gaps between the existing research resources and the needs. and of outlining a program of research through which the petroleum engineering departments can be collectively of maximum service. Such an agenda would be of value to the profession of petroleum engineering, to industry and to government agencies, as well as to the faculty and students of the petroleum engineering departments. The purposes of the activity that led to this report, therefore, were to develop a statement to serve as a beginning research agenda for the petroleum engineering academic community; to bring together representatives of the petroleum engineering academic community to recognize the importance of developing a consensus posture with respect to research; and to provide a document that will assist in portraying to industry, government agencies and others the problems and needs of the petroleum engineering departments for conducting research. Contents of this report include; introduction; the background; the scope of petroleum engineering research; priority research topics and technological issues; non-technological research issues; and conclusions and recommendations.

105 (DOE/NV/10412–3) **Department of Petroleum Engineering and Center for Petroleum and Geosystems Engineering annual report, 1990–1991 academic year.** Texas Univ., Austin, TX (United States). [1991]. 107p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC07-85NV10412. Order Number DE93000934. Source: OSTI; NTIS; GPO Dep.

The Department of Petroleum Engineering at The University of Texas at Austin is one of more than 20 such departments in the United States and more than 40 worldwide. The department has more than 20 faculty members and, as of the fall of 1990, 146 undergraduate and 156 graduate students. During the 1990–91 academic year, undergraduate enrollment is up slightly from the several downturns that began in 1986; graduate enrollment continues to increase, significantly in the number of Ph.D. candidates enrolled. The 1990–91 academic year was one of consolidation of gains. A remote teaching program in the Midland-Odessa area was initiated. During 1991, the Center for Petroleum and Geosystems Engineering (CPGE) continued its large, diversified research activities related to oil, gas and geopressured/geothermal energy production, energy and mineral resources analysis, and added new research projects in other areas such as groundwater remediation. Many of these research projects included interdisciplinary efforts involving faculty, research scientists and graduate students in chemistry, mathematics, geology, geophysics, engineering mechanics, chemical engineering, microbiology and other disciplines. Several projects were undertaken in cooperation with either the Bureau of Economic Geology or the Institute for Geophysics at The University of Texas at Austin. Collaborative research projects with scientists at Brookhaven National Laboratory, Los Alamos National Laboratory, Rice University, and Sandia National Laboratory were also initiated. About 43 companies from seven countries around the world continued to provide the largest portion of research funding to CPGE.

106 (IFP–38544) **Surge and swab pressures in the annulus of oil wells while roundtrips operations.** Al-Delaimi, S. Institut Francais du Petrole (IFP), 92 - Rueil-Malmaison (France); Universite de Technologie de Compiegne, 60 (France). Apr 1991. 234p. (In French). Order Number DE93721368. Source: OSTI; NTIS (US Sales Only).

Surge and swab pressures are difficult to evaluate. Operating parameters were measured with Newtonian and non-Newtonian fluids. The effects of the thixotropy and the salinity of suspensions were also investigated. The values of surge and swab pressures obtained are related to the instantaneous physico-chemical state of these suspensions. The precision of the rheological parameters and a precise model are very important. The hypothesis of the equality between surge and swab pressures is not always valid, where the phenomenon of piston action appears easily in most of the cases. The pressure coming from the effect of viscosity is much more important than from inertia and from gelification. Also it was found that the gradients of pressures are a quasi linear functions of depth. The theoretical fluid flow friction factor in the annulus is underestimated. A value of 36 is proposed for the product of friction factor by the Reynolds number. Appendices are included in volume 2.

107 (IFP–38544A) **Surge an swab pressures in the annulus of oil wells while roundtrips operations. Vol.2.** Al-Delaimi, S. Institut Francais du Petrole (IFP), 92 - Rueil-Malmaison (France); Universite de Technologie de Compiegne, 60 (France). Apr 1991. 80p. (In French). Order Number DE93721369. Source: OSTI; NTIS (US Sales Only).

This second volume includes only the appendices of the thesis. In particular experimental results of swab and surge pressure obtained with newtonian fluids, bentonite, carboxymethylcellulose solutions and their mixtures and also influence of salinity, thixotropy celerity and acceleration.

108 (IFP–39895) **Comparative study of thermodynamical properties and research on miscibility between injection gases and light petroleum: Mesdar and Zarzaitine oil fields applications.** Naili, N. Lyon-1 Univ., 69 (France). 27 Feb 1992. 332p. (In French). Order Number DE93721353. Source: OSTI; NTIS (US Sales Only).

Several of Algerian oil reservoirs are now at the end of their exploitation eventhough most of the oil is still in place. The implementation of an enhanced oil recovery method can yield a substantial amount of additional oil. A good knowledge of the thermodynamic properties of crude oil in presence of various gases either conventional (methane, CO2, rich gas), or not (nitrogen, flue gas) is absolutely necessary for understanding the physical and chemical mechanisms involved in the field of enhanced oil recovery by miscible or immiscible gas injection. The present work deals with a study of two natural crude oils. One coming from the Mesdar field, the other from the Zarzaitine field. After a classical PVT (Pressure Volume Temperature) study of two crude oils alone, the same measurements were carried out with many mixtures 'oil+injection gas'. In a second step, displacements of both oils in an artificial porous medium were performed, and the minimum miscibility pressures (MMP) were measured with different gases.

Finally, two numerical simulations were carried out. The first with a 'PVT package' model to restitute thermodynamic properties of the two crude oils and their mixtures with the different gases, the second by means of a new 'ΣCORE' model to simulate the displacements. 63 refs.

109 (NEI-NO–279) **Scale formation during oil recovery: A kinetic model.** Rollheim, M. Trondheim Univ. (Norway). Norges Tekniske Hoegskole. 1991 190p. Order Number DE93721629. Source: OSTI; NTIS.

A kinetic model for the precipitation - dissolution of the scale forming minerals $BaSO_4$, $SrSO_4$, $CaCO_3$, $FeCO_3$, $CaSO_4$, and $CaSO_4x2H_2O$, including the kinetics of the CO_2-H_2O system, is developed. The model is based on experimental data on the kinetics of these reactions in aqueous solutions. Influence of temperature, pressure and ionic strength on the solubility of these minerals is included using a predeveloped solubility model. By combining the kinetic model with a hydrodynamic model for the simultaneous transport of oil, water and gas in the near well area and in the production tubing, it is possible to estimate in which part of the production system scaling will occur. $BaSO_4$ precipitation experiments has been performed in steel tubing in order to obtain knowledge about scaling mechanisms. Two waters, one containing Ba^{2+} the other SO_4^{2-}, were mixed at the entrance of the tubing and the amount of scale formed and the concentration of barium ions along the pipe were measured. Comparison between experimental data and the scale prediction model show that the model is capable of predicting the Ba^{2+} concentration profiles and therefore also the amount of $BaSO_4$(s) formed, along the tubing. The $BaSO_4$ scale profile is slightly underestimated due to nucleation and particle transport processes which are not accounted for. A linear relationship is indicated between the surface area for crystal growth and the inverse tube radius. This is in accordance with model predictions. Model calculations on a North Sea well gave a scale build-up profile along the 2800 m long tubing from the bottom to the well, which agreed quantitatively with the scale thickness measured in the tubing. 154 refs., 31 figs., 5 tabs.

110 (NIPER–613) **National Institute for Petroleum and Energy Research quarterly technical report, April 1–June 30, 1992: Volume 2, Energy production research.** National Inst. for Petroleum and Energy Research, Bartlesville, OK (United States). Sep 1992. 55p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC22-83FE60149. Order Number DE93001397. Source: OSTI; NTIS; GPO Dep.

Progress reports are presented for: chemical flooding–supporting research; gas displacement-supporting research; thermal recovery-supporting research; geoscience technology; resource assessment technology; and microbial technology. (AT)

111 **Method and apparatus for the determination of formation fluid flow rates and reservoir deliverability.** Peterson, G. 18 Jul 1992. Filed date 17 Jan 1991. Canada Patent patent application 2034444. 17p. Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN.

A method and apparatus are provided for measuring fluid flow rates and the absolute open flow (AOF) potential of a subterranean formation penetrated by a wellbore. The invention can be described as a formation fluid flow rate test tool which is conveyed and operated on a wireline logging cable. The downhole test tool comprises an arrangement of inflatable packers to isolate an interval and a pump which extracts fluid from the formation through an inlet below the uppermost packer. The method allows for sequentially increasing or decreasing the pump rate and hence flow rates and measuring the corresponding pressures. From these data, the reservoir flow characteristics, properties and deliverability can be accurately calculated, which was not previously permitted with other known wireline-conveyed sampling and testing tools. In addition, the invention allows for the reservoir parameters to be obtained under dynamic conditions, emulating an AOF test which was previously only obtained after completion of the well. This method and apparatus presents an economical and time effective technique with which to enter into a decision regarding the disposition of a wellbore. 5 figs.

0204 Processing

112 (IFP–39436) **Thermal cracking of hydrocarbon mixtures at high pressure: experimental kinetic study and numerical modeling, implications for petroleum geochemistry.** Kressmann, S. Paris-6 Univ., 75 (France); Institut Francais du Petrole (IFP), 92 - Rueil-Malmaison (France). 20 Nov 1991. 294p. (In French). Order Number DE93721296. Source: OSTI; NTIS (US Sales Only).

The aim of this work is to have a better understanding of the elementary reactions involved in thermal cracking of crude oil in sedimentary basins, and to study their kinetics as a function of temperature and pressure. The knowledge of these reactions together with their kinetic parameters is possible through pyrolysis of simple mixture of pure compounds at low conversion. Experiments have been carried out on two simple mixtures: n-hexane + benzene and n-hexane + 2-4dimethylpentane, which were chosen because products of the reactions were simple enough for identification and quantification and these compounds are considered to be representative of hydrocarbon structures present in crude oils. Pyrolysis were performed in closed gold cells at different pressures (10, 20 and 200 MPa) and temperatures (300-400 deg C). Experimental results obtained for the mixture n-hexane+2-4dimethylpentane indicate that the overall pyrolysis rate increase of a factor of about two at five when the pressure increases from 10 MPa to 200 MPa. For the mixture n-hexane+benzene the effect of pressure is to decrease sightly the overall pyrolysis rate for the same range of pressure. The kinetic models consist of a succession of free radical reactions with intermediate compounds occurring at low concentrations (radical, unsaturates for instance). The numerical simulations of the chemical models for the mixture of n-hexane+benzene at lower conversion are in agreement with the experimental data. We developed a method to lump the chemical kinetic equations in order to find a way to simulate the n-hexane+2-4dimethylpentane reaction mechanism and to elaborate a semi empirical model for thermal cracking of crude oil. The final goal is to predict the thermal evolution of crude oils in reservoirs for petroleum exploration, we compared our numerical simulation results with a kinetic model of crude oil. 116 refs., 50 figs., 67 tabs.

113 (IFP–39564) **Hydrogen interaction with catalyst support Platinum. Influence of particle size, additives and type of catalyst support.** Rochefort, A. Paris-6 Univ., 75 (France); Institut Francais du Petrole (IFP), 92 - Rueil-Malmaison (France); Ecole Nationale Superieure du Petrole et des Moteurs (ENSPM), 92 - Rueil-Malmaison (France). 22 Jan 1992. 195p. (In French). Order Number DE93721298. Source: OSTI; NTIS (US Sales Only).

Cycloalkanes are the principal constituent of petroleum fractions during catalytic reforming. Their dehydrogenation gives a major part of aromatic compounds and hydrogen. In this thesis, the influence of particle size on Platinum activation energy, in opposite to cycloalkanes or hydrogen, is studied. Additives effects (as Chlorine or Potassium) on physico chemical and catalytic properties of Platinum catalyst supports are described. 156 refs., 53 figs., 24 tabs.

114 (IFP–39696) **Petroleum hydrocracking face to face Molybdenum based dispersed catalyst.** Elmouchnino, J. Paris-6 Univ., 75 (France); Institut Francais du Petrole (IFP), 92 - Rueil-Malmaison (France). 27 Mar 1992. 338p. (In French). Order Number DE93721297. Source: OSTI; NTIS (US Sales Only).

This study has analysed the behaviour of petroleum during hydrocracking process. The conversion is an heterogeneous catalysis realized under hydrogen pressure, face to face a molybdenum dispersed catalyst. The qualitative improvement of coke formation is in relation with the hydrogen transfer effect and dispersed catalyst quantity. A preprocessing stage, as molybdophosphoric acid used as precursor, allows to obtain dispersed catalyst. The association of dispersed catalyst with a poly aromatic compound (pyrene, catalytic slurries) may create a synergy effect on the control of coke formation. The study of the 9-dodecyl phenanthrene allows to quantify catalyst activation energy. The study of reactions responsible of semi coke formation has been realized with the help of acenaphtylene. 152 refs., 78 figs., 57 tabs.

115 **Normal paraffin adsorptive separation using non-normal hydrocarbon pre-pulse stream.** Kulprathipanja, S. 1 Aug

1992. Filed date 31 Jan 1991. Canada Patent patent application 2035337. 33p. Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN.

An adsorptive separation process for separating normal paraffins from non-normal hydrocarbons in which the paraffins have from about 10 to about 35 carbon atoms per molecule utilizes a molecular sieve adsorbent having an effective channel diameter of ca 5 angstroms. According to the invention, this process is improved by passing a non-normal hydrocarbon input stream into the adsorption zone at adsorption conditions to promote the selective adsorption of the straight chain hydrocarbon constituents of the feed material in contact with the adsorbent in preference to the lighter straight chain hydrocarbon constituents of the desorbent material also in contact with the adsorbent. The preferred normal paraffins in the desorbent are C_{4-8} and the preferred non-normal hydrocarbons in the desorbent, when used, are branched chain paraffins having lower carbon numbers than those in the feed stream. Experiments are described to illustrate the process of the invention. 2 figs., 7 tabs.

0206 Health and Safety

Refer also to citation(s) 1554

116 (CMI-R–91/A25014) **Generation, ignition, combustion and explosion of sprays and mists of flammable liquids in air: A literature survey.** Eckhoff, R.K. Christian Michelsens Inst. for Vitenskap og Aandsfrihet, Bergen (Norway). Jun 1991. 114p. Order Number DE93721651. Source: OSTI; NTIS.

The spray/mist explosion hazard is illustrated by reported accidents. Experimental and theoretical studies of generation and physical behavior of spray/mists, of ignition and flame propagation, including detonation, and of diagnostic methods in experimentation, are reviewed. Some topics requiring further investigation are mentioned. 247 refs.

117 (NEI-NO–265) **Guidelines on qualifications for personnel engaged in manned underwater operations in the petroleum activities.** Oljedirektoratet, Stavanger (Norway). 1990 20p. (In English, Norwegian). Order Number DE93721652. Source: OSTI; NTIS.

The publication deals with the guidelines on qualifications for personnel engaged in manned underwater operations in the petroleum activities, to the Norwegian Petroleum Directorate's Regulations concerning manned underwater operations in the petroleum activities, laid down by the Norwegian Petroleum Directorate 11 June 1990. The guidelines have been issud by the Norwegian Petroleum Directorate 11 June 1990.

118 (NEI-NO–266) **Regulations concerning manned underwater operations in the petroleum activity.** Oljedirektoratet, Stavanger (Norway). 1991 53p. (In English, Norwegian). Order Number DE93721653. Source: OSTI; NTIS.

The publication deals with the regulations concerning manned underwater operations in the petroleum activity, issued by the Norwegian Petroleum Directorate and the Directorate of Public Health 11 June 1990. The regulation is issued pursuant to regulations concerning safety etc. stipulated by Royal Decree of 28 June 1985 pursuant to paragraph 7, 23 and 48, cfr. delegation authority made by the Royal Norwegian Ministry of Local Government 28 June 1985, cfr. delegation of authority made by the Royal Ministry of Health and Social Affairs 5 September 1985. 1 tab.

119 (NEI-NO–267) **Regulations concerning safe practice in exploration and exploration drilling for petroleum deposits on Svalbard.** Oljedirektoratet, Stavanger (Norway). 1988 32p. (In English, Norwegian). Order Number DE93721654. Source: OSTI; NTIS.

The publication deals with the regulations concerning safe practice in exploration and exploration drilling for petroleum deposits on Svalbard, with comments issued by Royal Decree of 25 March 1988 by virtue of Section 4 og the Act of 17 July 1925, No 11, relating to Spitzbergen (Svalbard).

120 (NEI-NO–268) **Guidelines for corrosion protection of installations.** Oljedirektoratet, Stavanger (Norway). 1989 13p. (In English, Norwegian). Order Number DE93721655. Source: OSTI; NTIS.

The publication deals with guidelines for corrosion protection of installations. Issued by the Norwegian Directorate 22 December 1987. Reference is made to "Regulation for the structural design of load-bearing structures intended for exploitation of petroleum resources", stipulated 29 October 1984. 16 refs., 5 tabs.

121 (NEI-NO–269) **Guidelines on selection of steels and fabrication of steel structures for the petroleum activity.** Oljedirektoratet, Stavanger (Norway). 1989 11p. (In English, Norwegian). Order Number DE93721656. Source: OSTI; NTIS.

The publication deals with guidelines on selection of steels and fabrication of steel structures should be used in conjunction with Regulations for structural design of load-bearing structures intended for exploitation of petroleum resources, stipulated by the Norwegian Petroleum Directorate on 29 October 1984. The guidelines were issued by the Norwegian Petroleum Directorate on 1 February 1989. 1 fig., 5 tabs.

122 (NEI-NO–271) **Guidelines on arrangement and contents of plan for development and operation of petroleum deposits.** Oljedirektoratet, Stavanger (Norway). 1990 17p. (In English, Norwegian). Order Number DE93721658. Source: OSTI; NTIS.

The publication deals with the guidelines on arrangement and contents of plan for development and operation of petroleum deposits, cf. Section 23 of the Petroleum Act, Section 15 of the Regulations supplementing the Act pertaining to petroleum activities and Section 10 of Regulations concerning safety etc. to the Act concerning petroleum activities. These guidelines have been issued by the Norwegian Petroleum Directorate on 6 September 1990.

123 (NEI-NO–272) **Guidelines on design and analysis of steel structures in the petroleum activity.** Oljedirektoratet, Stavanger (Norway). 1990 76p. (In English, Norwegian). Order Number DE93721659. Source: OSTI; NTIS.

The publication deals with guidelines on design and analysis of steel structures should be used in conjunction with Regulations for structural design of load-bearing structures intended for exploitation of petroleum resources, stipulated by the Norwegian Petroleum Directorate on 29 October 1984. These guidelines were issued by the Norwegian Petroleum Directorate on 3 January 1990. 17 refs., 23 figs., 15 tabs.

124 (NEI-NO–273) **Regulations concerning implementation and use of risk analyses in the petroleum activities with guidelines.** Oljedirektoratet, Stavanger (Norway). 1990 15p. (In English, Norwegian). Order Number DE93721660. Source: OSTI; NTIS.

The publication deals with the regulations concerning implementation and use of risk analyses in the petroleum activities, issued by the Norwegian Petroleum Directorate 12 July 1990 pursuant to Section 7 of Regulations concerning safety etc., laid down by Royal Decree of 28 June 1985, cf. Section 8-12 cf. decision concerning delegation of authority by the Ministry of Local Working Environment Act, Section 14, third paragraph, cf. Royal Decree of 4 June 1982, and laid down by the Ministry of the Environment 4 December 1990 pursuant to Section 40, second paragraph, of the Pollution Control Act.

125 (NEI-NO–274) **Regulations concerning pipeline systems in the petroleum activities.** Oljedirektoratet, Stavanger (Norway). 1990 49p. (In English, Norwegian). Order Number DE93721661. Source: OSTI; NTIS.

The publication deals with the regulations concerning pipeline systems in the petroleum activities, issued by the Norwegian Petroleum Directorate 30 April 1990 pursuant to Regulations concerning safety etc., laid down by Royal Decree of 28 June 1985, cf. Section 7, cf. Sections 49-51, cf. decision concerning delegation of authority by the Ministry of Local Government and Labour of 28 June 1985. 7 tabs.

126 (RF–9/91) **Using foam to reduce sand production.** Dalland, M.; Hanssen, J.E. Rogalandsforskning, Stavanger (Norway). Jan 1991. 13p. Order Number DE93721643. Source: OSTI; NTIS.

The intention with this project was to investigate the possible use of foam as a new method for reduction of sand production. This could be an alternative method for the conventional gravel pack, or a substitute. A laboratory model was constructed for the purpose of being able to produce sand in a controlled manner. The equipment proved unsatisfactory because particles appear to be produced by a different mechanism from that expected in the field, but improvements are proposed. Criteria for selecting foam systems for this application are defined in light of a proposed mechanisms of action. A suitable foam system for laboratory model studies is identified. Based on this system and these criteria it appears likely that a field-testable foam system can be found with a reasonable amount for product screenings. 16 refs., 7 figs.

0207 Economic, Industrial, and Business Aspects

Refer also to citation(s) 365, 752, 792, 793, 794

127 (DOE/BC/14483–16) **Natural Resources Information System for the State of Oklahoma: Final report.** Mankin, C.J. Oklahoma Univ., Norman, OK (United States). [1992]. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-89BC14483. Order Number DE92040972. Source: OSTI; NTIS; INIS; GPO Dep.

The objective of this research program was to continue developing, editing, maintaining, utilizing and making publicly available the Natural Resources Information System (NRIS) for the State of Oklahoma. The Oklahoma Geological Survey, working with Geological Information Systems at the University of Oklahoma's Sarkeys Energy Center, undertook to construct this information system in response to the need for a computerized, centrally located library containing accurate, detailed information on the state's natural resources. Particular emphasis during this phase of development was placed on computerizing information related to the energy needs of the nation, specifically oil and gas.

128 (DOE/BC/14853–2) **Continued support of the "The Natural Resources Information System (NRIS) for the State of Oklahoma": Quarterly technical progress report, July 1, 1992–September 30, 1992.** Mankin, C.J. (Oklahoma Geological Survey, Norman, OK (United States)); Rizzuti, T.P. Oklahoma Geological Survey, Norman, OK (United States); Oklahoma Univ., Norman, OK (United States). [1992]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-92BC14853. Order Number DE93002229. Source: OSTI; NTIS; GPO Dep.

The objective of this research program is to continue developing, editing, maintaining, utilizing and making publicly available the Oil and Gas Well History file portion of the Natural Resources Information System (NRIS) for the State of Oklahoma. This grant funds that ongoing development work as a continuation of earlier grant numbers DE-FG19-88BC14233 and DE-FG22-89BC14483. The Oklahoma Geological Survey, working with Geological Information Systems at the University of Oklahoma Sarkeys Energy Center, has undertaken to construct this information system in response to the need for a computerized, centrally located library containing accurate, detailed information on the state's natural resources. Particular emphasis during this phase of NRIS development is being placed on computerizing information related to the energy needs of the nation, specifically oil and gas.

129 (DOE/EIA–0520(92/09)) **International petroleum statistics report, September 1992.** USDOE Energy Information Administration, Washington, DC (United States). Office of Energy Markets and End Use. 28 Sep 1992. 70p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93000888. Source: OSTI; NTIS; GPO; GPO Dep.

The International Petroleum Statistics Report presents data on international oil production, demand, imports, exports, and stocks. The report has four sections. Section 1 contains time series data on world oil production, and on oil demand and stocks in the Organization for Economic Cooperation and Development (OECD). This section contains annual data beginning in 1980, and monthly data for the most recent two years. Section 2 presents an oil supply/demand balance for world. This balance is presented in quarterly intervals for the most recent two years. Section 3 presents data on oil imports by OECD countries. This section contains annual data for the most recent year, quarterly data for the most recent two quarters, and monthly data for the most recent twelve months. Section 4 presents annual time series data on world oil production and oil stocks, demand, and trade in OECD countries. World oil production and OECD demand data are for the years 1970 through 1991; OECD stocks from 1973 through 1991; and OECD trade from 1982 through 1991.

0208 Waste Management

Refer also to citation(s) 892

0209 Environmental Aspects

Refer also to citation(s) 758, 1257, 1556

130 (DOE/EIS–0165-D-Vol.1) **Draft Environmental Impact Statement on the expansion of the Strategic Petroleum Reserve, Alabama, Louisiana, Mississippi, and Texas: Volume 1, Chapters 1–5.** USDOE, Washington, DC (United States). Oct 1992. 445p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93002186. Source: OSTI; NTIS; GPO Dep.

The proposed action entails the development of a plan for 250 million barrels of new crude oil storage capacity in two Gulf Coast salt domes to expand the Strategic Petroleum Reserve pursuant to Congressional directive (PL 101–383 and PL 101–512). Storage capacity would be developed by solution-mining the salt which would require about two billion barrels of surface water and would generate about two billion barrels of salt brine. The brine would be disposed of primarily by ocean discharge and alternatively by deep underground injection. Crude oil fill and distribution systems would require new pipelines and terminal facilities. This EIS assesses the impacts of construction and operation for the range of alternatives being considered and focuses on oil and brine spill risk and impacts of brine disposal, water and land use, groundwater contamination, hydrocarbon emissions, and involvement with wetlands and floodplains.

131 (EUR–14236) **Effects of organic contaminants in sewage sludge on soil fertility, plants and animals.** Hall, J.E. (ed.) (Water Research Association, Medmenham (United Kingdom)); Sauerbeck, D.R. (ed.); L'Hermite, P. (ed.). Commission of the European Communities, Luxembourg (Luxembourg). 1992. 224p. (CONF-9006428–: Seminar on Effects of organic contaminants in sewage sludge on soil fertility, plants and animals, Braunschweig (Germany), 6-8 Jun 1990). Source: OSTI; NTIS (US Sales Only); INIS.

Sewage sludge production in Europe will continue to rise as a result of higher environmental standards, making disposal increasingly difficult in the future. A considerable part of this sludge is spread beneficially on agricultural land as an organic fertilizer, however, this outlet is very sensitive to the problems associated with the inorganic and organic contaminants which sludge inevitably contains. Much research has been devoted to the problems of contaminants in sludge and their potential effects on soil, plants, animals and man in recent years, and the European Commission's Concerted Action COST 681 has provided a valuable forum for the exchange of views and progress of research on sludge treatment and disposal. This book contains 19 papers presented to a joint meeting of Working Party 4 (Agricultural Value) and Working Party 5 (Environmental Effects) of COST 681, held at the German Federal Research Centre of Agriculture (FAL), Braunschweig on 6-8 June 1990. The meeting addressed two areas of current concern; the occurrence, behaviour and transfer of sludge-derived organic contaminants (Session 1), and the influence of inorganic and organic contaminants on soil micro-organisms and their activities (Session 2).

132 (EUR–14236, pp. 35-44) **Chlorinated hydrocarbons and PCBs in field soils, sediments and sewage sludges.** Schaaf, H. (Hessische Landwirtschaftliche Versuchsanstalt, Kassel (DE)). Commission of the European Communities, Luxembourg (Luxembourg). 1992. (CONF-9006428–: Seminar on Effects of organic contaminants in sewage sludge on soil fertility, plants and

animals, Braunschweig (Germany), 6-8 Jun 1990). In *Effects of organic contaminants in sewage sludge on soil fertility, plants and animals.* 224p. Order Number DE93721694. Source: OSTI; NTIS (US Sales Only); INIS.

As requested by the Ministry of Agriculture of the FRG, the 'Verband Deutscher Landwirtschaftlicher Untersuchungs- und Forschungsanstalten (VDLUFA)' built up a data collection over chlorinated hydrocarbons and PCBs in field soils, sediments, sewage sludges. Nearly 70.000 samples were collected and statistically evaluated. The results of these investigations will be described. The major constituents of the chlorinated hydrocarbons generally were Lindane, DDT(total) and HCB. In sewage sludges PCBs could be detected in nearly every sample. The contents of PCBs in field soils are smaller than in sewage sludges. Rather 'high contents', greater than 100-200 μg/kg d.m./organic pollutants, were detected only in 2% of the samples. 7 refs., 5 figs., 2 tabs.

133 (EUR–14236, pp. 70-77) **The persistence of polynuclear aromatic hydrocarbons in sewage sludge-amended agricultural soils.** Wild, S.R. (Lancaster Univ. (United Kingdom)); Jones, K.C.; Berrow, M.L. Commission of the European Communities, Luxembourg (Luxembourg). 1992. (CONF-9006428–: Seminar on Effects of organic contaminants in sewage sludge on soil fertility, plants and animals, Braunschweig (Germany), 6-8 Jun 1990). In *Effects of organic contaminants in sewage sludge on soil fertility, plants and animals.* 224p. Order Number DE93721694. Source: OSTI; NTIS (US Sales Only); INIS.

In 1968 five metal enriched sewage sludges containing different concentrations of polynuclear aromatic hydrocarbons (PAHs) were applied to different plots on field soils at two experimental sites, Luddington and Lee Valley in the UK. This resulted in substantial increases in soil ΣPAH concentrations in all plots. Since application compound specific losses have occurred, with the high molecular weight PAHs being more persistent. Calculated half-lives range from under 2 years for naphthalene to over 9 years for benzo[ghi]perylene and coronene. The loss of PAH compounds in these field experiments can be related, in part, to certain physicochemical properties, namely water solubility and the octanol:water partition coefficients. 20 refs., 3 figs., 1 tab.

134 (INIS-mf–13372) **Second workshop of participants in the Joint FAO-IOC-WHO-IAEA-UNEP project on monitoring of pollution in the marine environment of the West and Central African Region (WACAF/2 - first phase).** IOC workshop report. United Nations Educational, Scientific and Cultural Organization (UNESCO), 75 - Paris (France). Intergovernmental Oceanographic Commission (IOC). 1988. 51p. (CONF-8806523–: 2. workshop of participants in the joint FAO-IOC-WHO-IAEA-UNEP project on monitoring of pollution in the marine environment of the West and Central African region, Accra (Ghana), 13 Jun 1988). Order Number DE93605632. Source: OSTI; NTIS (US Sales Only); INIS.

The Second Workshop of Participants in the Joint FAO-IOC-WHO-IAEA-UNEP Project on Monitoring of Pollution in the Marine Environment of the West and Central African Region (WACAF/2) was attended by 29 participants from 10 countries (Senegal, The Gambia, Sierra Leone, Cote d'Ivoire, Ghana, Benin, Nigeria, Cameroun, Congo and Gabon). Levels of metals, chlorinated hydrocarbons and petroleum components in marine biota were discussed in seven scientific reports which were presented by the participating scientists (Cote d'Ivoire, Sierra Leone, Nigeria, The Gambia, ghana and Cameroun). Three of the presented reports were on organochlorines and four dealt with trace metal levels in marine organisms. The Representative of the International Atomic Energy Agency (IAEA) reviewed the results obtained during the data quality assurance intercalibration exercises carried out in the region during the first phase. The result received are still within acceptable range. However, there seems to be a trend for values to be higher than the range of finally certified concentrations. Considering that most results were clearly better in the second exercise, after equipment service, part of the earlier deviation might be attributed to instrument malfunctions. These results can be regarded as fairly encouraging for the future development in the West and Central African marine pollution monitoring programme. Refs, tabs.

135 (NEI-NO–270) **Regulations on environmental data for the petroleum activity.** Oljedirektoratet, Stavanger (Norway). 1990 14p. (In English, Norwegian). Order Number DE93721657. Source: OSTI; NTIS; INIS; inis.

The publication deals with the regulations on environmental data for the petroleum activity, stipulated by the Norwegian Petroleum Directorate on 1 December 1989 pursuant to Royal Decree of 28 June 1985, cf. Sections 7 and 33, cf. delegation of authority by the Ministry of Local Government and Labour of 28 June 1985. 1 tab.

136 (YMP-D–53/1988) **Inventory of volatile organic compound emissions in Finland, 1985.** Mroueh, U.M. (Helsinki Univ. of Technology, Espoo (Finland). Chem. Lab.). Ministry of the Environment, Helsinki (Finland). Environmental Protection Dept. 1988. 34p. Order Number DE93711140. Source: OSTI; NTIS; INIS.

The aim of the study was to compile an inventory of the emissions of volatile organic compounds in Finland for the year 1985. The report was prepared for the ECE Task Force on Emissions of Volatile Organic Compounds from Stationary Sources according to the classification given by the Task Force. It considers anthropogenic as well as natural sources. Mobile sources are excluded. The quantities as well as the main components are listed, as far as possible. The values given exclude methane which according to the present understanding is regarded as unreactive.

0210 Legislation and Regulations

Refer also to citation(s) 135

0220 Transport, Handling, and Storage

Refer also to citation(s) 1256

137 **Oil containment and shipping device.** Masse, B.; Nelson, F. 1 Aug 1992. Filed date 31 Jan 1991. Canada Patent patent application 2035326. 4p. Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN.

An environmentally safe apparatus for the containment and transportation of oil and liquid fuels is comprised of an inner bladder and an outer covering of stainless steel mesh around the inner bladder and molded at the filler/vent fitting to prevent tearing. The inner bladder is made of half-inch neoprene rubber for containment of 25,000 imperial gallons. The steel mesh outer covering is designed to protect the inner bladder in case of accidents which could cause tearing of the bladder. The containment bladder of the invention is designed to be incorporated into existing tanker holds and thus eliminate the need for double hulling. 1 fig.

0230 Properties and Composition

138 (NIPER–621-Vol.1) **[National Institute for Petroleum and Energy Research] quarterly technical report, April 1–June 30, 1992: Volume 1, Fuels research.** National Inst. for Petroleum and Energy Research, Bartlesville, OK (United States); National Inst. for Petroleum and Energy Research, Bartlesville, OK (United States). Aug 1992. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC22-83FE60149. Order Number DE92041200. Source: OSTI; NTIS; GPO Dep.

Progress reports are presented for the following two tasks: development of analytical methodology for analysis of heavy crudes; and thermochemistry and thermophysical properties of organic nitrogen- and diheteroatom-containing compounds. Objectives for task one are: to identify compounds or classes of compounds with significant positive or negative effects on crude oil and/or product properties and characteristics and to develop methods for their determination in conventional or low grade petroleum and syncrudes. Specific objectives for FY92 are: to determine catalytic cracking behavior of individual compound classes in petroleum; and to further develop GC/MS methodology for speciation of nitrogen and sulfur compound in petroleum. Objective for task two is to provide, interpret, and correlate with molecular structure and polarity of molecules, precise and accurate values of thermodynamic properties of organic nitrogen and diheteroatom-containing compounds that occur in or are readily derivable from heavy petroleum and oil shale. The results will enable the prediction of chemical equilibria for conceptual as well as current processes.(AT)

03 NATURAL GAS

0302 Reserves, Geology, and Exploration

Refer also to citation(s) 97, 99, 139, 143, 1775, 1776

0303 Drilling, Production, and Processing

Refer also to citation(s) 50, 102, 104, 105, 111

139 (DOE/MC/24120–3121) **Results of field verification tests in the Tight Mesaverde Group: Piceance Basin, Colorado: Final report.** Kukal, G.C.; Price, E.H.; Hill, R.E.; Monson, E.R. CER Corp., Las Vegas, NV (United States). Aug 1992. 153p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC21-88MC24120. Order Number DE93000201. Source: OSTI; NTIS; GPO Dep.

The Piceance Basin of western Colorado contains a major potential natural gas resource in Mesaverde blanket and lenticular low permeability gas sands. The basin has been a pilot study area for government sponsored tight gas sand research for over 20 years. This work culminated in the Multiwell Experiment (MWX), a field laboratory consisting of three closely spaced wells, designed by the Department of Energy to study the reservoir and production characteristics of the low permeability sands of the Mesaverde Group in the Rulison Field near Rifle, Colorado. The purpose of this study is to compare geologic, production and reservoir characteristics of the existing Mesaverde producing areas in the Piceance Basin with those same characteristics at the Multiwell site. This study has been performed in two sequential parts, Phase I and Phase II. In Phase I the geologic, production and reservoir engineering parameters were developed for the existing Mesaverde gas producing areas through analysis of log suites, well completion information and production histories. The southern part of the basin was partitioned into three areas having similar geologic and production characteristics. Phase II consisted of field verification tests with cooperative industry partners in which new subsurface geologic and production information was collected in the partitioned areas to be compared with that at MWX. This report presents the results of Phase II investigations.

140 (DOE/MC/26024–3109) **Slant hole completion test (1991) sidetrack "as built" report.** Myal, F.R. CER Corp., Las Vegas, NV (United States). May 1992. 132p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC21-90MC26024. Order Number DE92012452. Source: OSTI; NTIS; GPO Dep.

During the summer of 1990, a slant hole test well, funded by the US Department of Energy, was drilled to 9,466 ft to evaluate the effectiveness of directional drilling in the tight, naturally fractured gas sands and coals of the Mesaverde Group. The surface location of the SHCT No. 1 is 700 ft south of the DOE Multiwell Experiment (MWX) site in Section 34, T6S, R94W, Garfield County, Colorado, approximately 7.5 miles west of Rifle. Mechanical problems following cementing of a production liner resulted in loss of the completion interval, and operations were suspended. In early 1991, DOE decided to sidetrack the hole to permit production testing of the lost interval. The sidetrack was designed to parallel the original wellbore, but to be drilled 1,000 ft to the east to minimize the chances of encountering formation damage from the original hole. The sidetrack, like the original hole, was to intersect the paludal lenticular sands and coals at 60° and to penetrate the underlying Cozzette sand horizonally. The sidetrack was spudded May 12, 1991. After re-entering the well in late 1991, early production testing of the Cozzette showed that the 300 ft of in-pay horizontal hole can produce at rate 5 to 10 times higher than vertical wells in the same area. This report contains the geological summary and sidetrack drilling operations summary.

141 (DOE/MC/27260–92/C0043) **Horizontal drilling in shallow, geologically complex reservoirs.** Venable, S.D. Hillin-Simon Oil Co., Midland, TX (United States). [1992]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC21-91MC27260. (CONF-920584–12: US Department of Energy contractor review meeting on natural gas research and development, Morgantown, WV (United States), 5-6 May 1992). Order Number DE93001426. Source: OSTI; NTIS; GPO Dep.

The objective of this project is to test the concept that multiple hydraulic fracturing from a directionally-drilled horizontal well, using the medium radius build rate method, can increase gas production sufficiently to justify economic viability over conventional stimulated vertical wells. The test well is located in Yuma County, Colorado, in a favorable area of established production to avoid exploration risks. This report presents: background information; project description which covers location selection/geologic considerations; and preliminary work plan. (AT)

142 (DOE/MC/28080–92/C0066) **Ground movements associated with gas hydrate production.** Siriwardane, H.J. West Virginia Univ., Morgantown, WV (United States). Coll. of Engineering. [1992]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG21-91MC28080. (CONF-920584–29: US Department of Energy contractor review meeting on natural gas research and development, Morgantown, WV (United States), 5-6 May 1992). Order Number DE93000398. Source: OSTI; NTIS; GPO Dep.

The mechanics of ground movements during hydrate production can be more closely simulated by considering similarities with ground movements associated with subsidence in permafrost regions than with gob compaction in a longwall mine. The purpose of this research work is to investigate the potential strata movements associated with hydrate production by considering similarities with ground movements in permafrost regions. The work primarily involves numerical modeling of subsidence caused by hydrate dissociation. The investigation is based on the theories of continuum mechanics , thermomechanical behavior of frozen geo-materials, and principles of rock mechanics and geomechanics. It is expected that some phases of the investigation will involve the use of finite element method, which is a powerful computer-based method which has been widely used in many areas of science and engineering. Parametric studies will be performed to predict expected strata movements and surface subsidence for different reservoir conditions and properties of geological materials. The results from this investigation will be useful in predicting the magnitude of the subsidence problem associated with gas hydrate production. The analogy of subsidence in permafrost regions may provide lower bounds for subsidence expected in hydrate reservoirs. Furthermore, it is anticipated that the results will provide insight into planning of hydrate recovery operations.

143 (DOE/MC/28239–92/C0067) **Horizontal drilling in the Lower Glen Rose Formation, Maverick County, Texas.** Drimal, C.E.; Muncey, G. PrimeEnergy Corp., Stamford, CT (United States). [1992]. 24p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC21-91MC28239. (CONF-920584–30: US Department of Energy contractor review meeting on natural gas research and development, Morgantown, WV (United States), 5-6 May 1992). Order Number DE93001427. Source: OSTI; NTIS; GPO Dep.

This paper presents preliminary results of a project to assess the economic viability of horizontal drilling in the Lower Glen Rose Formation of Maverick County, Texas. This project is part of an ongoing Department of Energy investigation of directional drilling in the development of gas resources within the United States. The paper includes: project description; results covering geologic setting, reservoir engineering, and seismic surveys; and future work on drilling location selection, drilling, and well completion. (AT)

144 (EUR–13926) **Low temperature preparation of physical solvents for the treatment of natural gas. Final report.** Larue, J. (Institut Francais du Petrole (IFP), 92 - Rueil-Malmaison (France)); Lermite, C. Commission of the European Communities, Luxembourg (Luxembourg). 1992. 42p. (In French). Contract EN3C-0033-F. Source: OSTI; NTIS (US Sales Only).

The aim of this project was to select and study physical solvents which can be employed at low temperature for the treatment of natural gas. These solvents will enable deacidification, dehydratation and removal of liquids to be carried out simultaneously, in a single step, cooling the natural gas on contact with the solvent. Two classes of solvents were considered: heavy solvents that

can be regenerated by distillation, a class including N-methylpyrrolidone, dimethylformamide and N-formylmorpholine, and the class of light solvents that can be regenerated by stripping the crude gas; in the latter class only methanol was considered. After an extensive study of the literature, complementary measurements, mainly consisting of equilibrium data, were carried out. In the course of the project, use of heavy solvents was abandoned and attention devoted entirely to methanol, which is plainly the best solvent for the above mentioned integrated process. Several thermodynamic models were tested on the complex multiphase equilibria involved, including the formation of hydrates at high inhibitor concentrations. Depending on the conditions, some of the more complex models can give good results, but none can represent accurately all the data gathered during this project. Generally, however, the data give sufficient indication that the integrated gas treatment process is thermodynamically viable. 11 refs., 14 figs., 3 tabs., 4 plates, 6 appendices.

0304 Products and By-Products

145 (NEI-NO–287) **Oligomerization of ethene on zeolite ZSM-5 type catalysts.** Dypvik, T. Trondheim Univ. (Norway). Norges Tekniske Hoegskole. 1992 173p. Order Number DE93721667. Source: OSTI; NTIS.

Oligomerization of ethene was performed with zeolite ZSM-5 catalysts. Activity and selectives of the catalysts as a function of reaction temperature in the temperature range 550-750 K were investigated in a microreactor. Some experiments were also performed at temperatures outside this range, and some experiments were performed varying the WHSV (Weight Hourly Space Velocity) and the partial pressure of ethene. A microbalance reactor was used for investigation of the coke formation during reaction. The zeolites were synthesized, and characterized with regard to crystallinity, specific surface area, morphology and chemical composition of the surface and bulk. In addition to HZSM-5, Sm-HZSM-5 and Nb-HZSM-5 were made. All three zeolites were ion-exchanged with nickel, HZSM-5 also with copper. For all the catalysts the ethene conversion increased with increasing reaction temperature until the temperature reached 650-700 K. Further increase of the reaction temperature led to decreased conversion. The decrease in conversion was not due to catalyst deactivation, as decreasing the temperature again, without catalyst regeneration, led to increased conversion. No indications were found for thermodynamic constraints limiting the conversion of ethene at high reaction temperature. A close relation was found between the catalytic stability obtained in the microreactor, and the catalyst weight increase under reaction conditions obtained in the microbalance reactor. This indicates the weight increase to be due, at least partly, to the formation of coke, which deactivated the catalyst. 108 refs., 80 figs., 18 tabs.

0305 Health and Safety

Refer also to citation(s) 122, 147

0306 Economic, Industrial, and Business Aspects

Refer also to citation(s) 127, 128, 129, 794, 799

146 (DOE/EIA–0130(92/09)) **Natural gas monthly, September 1992.** USDOE Energy Information Administration, Washington, DC (United States). Office of Oil and Gas. 24 Sep 1992. 140p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93001253. Source: OSTI; NTIS; GPO; GPO Dep.

The Natural Gas Monthly (NGM) is prepared in the Data Operations Branch of the Reserves and Natural Gas Division, Office of Oil and Gas, Energy Information Administration (EIA), US Department of Energy (DOE). The NGM highlights activities, events, and analyses of interest to public and private sector organizations associated with the natural gas industry. Volume and price data are presented each month for natural gas production, distribution, consumption, and interstate pipeline activities. Producer-related activities and underground storage data are also reported. From time to time, the NGM features articles designed to assist readers in using and interpreting natural gas information.

0310 Legislation and Regulations

147 (EUR–13699) **Community documentation centre on industrial risk. Comparison of Liquefied Petroleum Gases (LPG) - related regulations.** Harris, S.; Arregger, J.E.; Trbojeric, V.M.; Cox, R.A. Commission of the European Communities, Luxembourg (Luxembourg). 1991. 356p. Contract 4019-90-06 ED ISP GB. Source: OSTI; NTIS (US Sales Only).

The Community Documentation Centre on industrial Risk (CDCIR), in addition to the collection of safety related documentation has in its objectives the production of review publications. Studies on, lessons learned from major accidents in the Community Member Countries, lessons learned after emergencies and a comparison of the national approaches to the safety report have been already published. This volume is the first one for the comparison of regulations and guidelines for handling and storing a specific substance. LPG being a flammable gas is a dangerous substances under the definitions given in the SEVESO-Directive. Its selection does not imply that is more dangerous than any other of the substances either explicitly listed in Annexes II and III, or classified as dangerous according to the criteria of Annex IV of this Directive. It mainly reflects the fact that it is widely used all over the Community (installations handling or storing LPG covered by the requirements of the SEVESO-Directive are to be found in all Member Countries) and consequently is involved very frequently in accidents. It is hoped that this publication will be helpful for the authorities and other interested bodies for the approximation of the national approaches to safety.

0320 Transport, Handling, and Storage

Refer also to citation(s) 146

148 (NEI-NO–286) **Gas tightness of unlined hard rock caverns.** Kjoerholt, H. Trondheim Univ. (Norway). Norges Tekniske Hoegskole. 1991 207p. Order Number DE93721666. Source: OSTI; NTIS.

The storage of natural gas in depleted oil and gas fields, aquifers and salt caverns is by far the most important field of underground gas storage today. In many areas, including most of the Scandinavian mainland, these storages are excluded due to geological conditions. For such areas, mined caverns in the hard, crystalline bedrock may provide an alternative. Oil and liquefied petroleum gases (LPG) at low pressure (<1.0 megapascal (MPa)) are routinely stored in excavated hard rock caverns. The major challenge in hard rock storages at present is the development of safe and economical high pressure storages for natural gas and CAES (Compressed Air Energy Storage). For the investigation of the performance of unlined hard rock storages, so-called air cushion surge chambers are found to provide the most relevant and extensive experience. These storages which have the function of damping transients in the head race tunnel at Norwegian hydro power plants, have pressures up to 8 MPa and volumes up to 110,000 m^3. Operational experience and results from specific water curtain tests at these sites, and other relevant experience are found to be in good agreement with theoretical results. Water curtains are installed at three of the ten air cushion surge chambers and at more than ten LPG-storages. The overall experience from these installations is encouraging; gas leakage has not been reported at any of these sites during ordinary operation. 91 refs., 77 figs., 14 tabs.

0340 Combustion

Refer also to citation(s) 89, 90, 851, 942

04 OIL SHALES AND TAR SANDS

0402 Reserves, Geology, and Exploration

149 (FRNC-TH–3721) **Phosphates and blackshales of the Oulab Abdoun and Timahdit basins (Morocco): Petrography, mineralogy, geochemistry and depositional environment.** Benalioulhaj, N. Strasbourg-1 Univ., 67 (France). Oct 1991. 261p. (In French). Order Number DE93721352. Source: OSTI; NTIS (US Sales Only).

The blackshale series of the Timahdit Basin represents a lateral synchronous facies of the phosphate series of the Oulad-Abdoun Basin. The Timahdit Basin is made up of an unstable and subsiding domain, while the Oulad-Abdoun Basin is part of a stable platform. The deposit is thicker, monotonous and rich in organic matter at Timahdit, whereas at Oulad-Abdoun, the deposit is of a reduced thickness, more diversified and rich in phosphates. These two basins belong to the same palaeographic domain, to the same marine paleogulf, which was under the influence of the same system of upwelling, more active in the Oulad-Abdoun Basin than in the Timahdit Basin which is situated landwards. These two basins have evolved in a globally reduced environment. In the Oulad-Abdoun Basin, frequent variations of redox conditions are responsible for the lithologic variety. The quasi-permanent anoxic conditions that have prevailed in the Timahdit Basin are marked by a poor preservation of dinocysts and by a low degree of carbonate substitution in the apatites. The diagenetic evolution of the organic matter has led to some mineral neoformations (apatites, sulphides, carbonates and clays) and has regulated the distribution of trace elements among the mineral phases from the stage of deposition of these series to their alteration. 255 refs., 61 figs., 38 tabs.

0404 Oil Production, Recovery, and Refining

Refer also to citation(s) 23

150 (DOE/MC/11089–3094-Vol.3) **Pressurized fluidized-bed hydroretorting of eastern oil shales: Volume 3, Task 4, Beneficiation research: Final report, September 1987–May 1991.** Institute of Gas Technology, Chicago, IL (United States). Mar 1992. 254p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC21-87MC11089. Order Number DE92001285. Source: OSTI; NTIS; GPO Dep.

The Mineral Resources Institute at the University of Alabama, along with investigators from the University of Pittsburgh and the University of Nevada Reno, have conducted a research program on the beneficiation of Eastern oil shales. The objective of the research program was to evaluate and adapt those new and emerging technologies that have the potential to improve the economics of recovering oil from Eastern oil shales. The technologies evaluated in this program can be grouped into three areas: fine grinding, kerogen/mineral matter separation, and waste treatment and disposal. Four subtasks were defined in the area of fine grinding. They were as follows: Ultrasonic Grinding, Pressure Cycle Comminution, Stirred Ball Mill Grinding, and Grinding Circuit Optimization. The planned ultrasonic grinding research was terminated when the company that had contracted to do the research failed. Three technologies for effecting a separation of kerogen from its associated mineral matter were evaluated: column flotation, the air-sparged hydrocyclone, and the LICADO process. Column flotation proved to be the most, effective means of making the kerogen/mineral matter separation. An investigation of waste treatment and disposal was conducted at the University of Alabama. Both liquid (water) and solid (tailings) wastes were investigated. Ion exchange and sulfide precipitation both proved to be effective in removing dissolved ions from tailing water. No problems are expected in the disposal of oil shale tailings. It is assumed that the tailings will be placed in a sealed pond and the water recycled to the plant as is the normal practice. It may be advantageous, however, to conduct further research on the recovery of metals as by-products and to assess the market for tailings as an ingredient in cement making.

151 (DOE/MC/11089–3107) **Pressurized fluidized-bed hydroretorting of Eastern oil shales – Sulfur control: Topical report for Subtask 3.1, In-bed sulfur capture tests; Subtask 3.2, Electrostatic desulfurization; Subtask 3.3, Microbial desulfurization and denitrification.** Roberts, M.J. (Institute of Gas Technology, Chicago, IL (United States)); Abbasian, J.; Akin, C.; Lau, F.S.; Maka, A.; Mensinger, M.C.; Punwani, D.V.; Rue, D.M.; Gidaspow, D.; Gupta, R.; Wasan, D.T.; Pfister, R.M.: Krieger, E.J. Institute of Gas Technology, Chicago, IL (United States); Illinois Inst. of Tech., Chicago, IL (United States); Ohio State Univ., Columbus, OH (United States). May 1992. 240p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC21-87MC11089. Order Number DE92041343. Source: OSTI; NTIS; GPO Dep.

This topical report on "Sulfur Control" presents the results of work conducted by the Institute of Gas Technology (IGT), the Illinois Institute of Technology (IIT), and the Ohio State University (OSU) to develop three novel approaches for desulfurization that have shown good potential with coal and could be cost-effective for oil shales. These are (1) In-Bed Sulfur Capture using different sorbents (IGT), (2) Electrostatic Desulfurization (IIT), and (3) Microbial Desulfurization and Denitrification (OSU and IGT). The objective of the task on In-Bed Sulfur Capture was to determine the effectiveness of different sorbents (that is, limestone, calcined limestone, dolomite, and siderite) for capturing sulfur (as H_2S) in the reactor during hydroretorting. The objective of the task on Electrostatic Desulfurization was to determine the operating conditions necessary to achieve a high degree of sulfur removal and kerogen recovery in IIT's electrostatic separator. The objectives of the task on Microbial Desulfurization and Denitrification were to (1) isolate microbial cultures and evaluate their ability to desulfurize and denitrify shale, (2) conduct laboratory-scale batch and continuous tests to improve and enhance microbial removal of these components, and (3) determine the effects of processing parameters, such as shale slurry concentration, solids settling characteristics, agitation rate, and pH on the process.

152 (DOE/MC/11089–3108) **Pressurized fluidized-bed hydroretorting of Eastern oil shales – Beneficiation: Topical report for Task 4, Beneficiation research.** Roberts, M.J. (Institute of Gas Technology, Chicago, IL (United States)); Lau, F.S.; Mensinger, M.C.; Schultz, C.W.; Mehta, R.K.; Lamont, W.E.; Chiang, S.H.; Venkatadri, R.; Misra, M. Institute of Gas Technology, Chicago, IL (United States); Alabama Univ., University, AL (United States); Pittsburgh Univ., PA (United States); Nevada Univ., Reno, NV (United States). May 1992. 247p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC21-87MC11089. Order Number DE92041344. Source: OSTI; NTIS; GPO Dep.

The Mineral Resources Institute at the University of Alabama, along with investigators from the University of Pittsburgh and the University of Nevada-Reno, have conducted a research program on the beneficiation, of Eastern oil shales. The objective of the research program was to evaluate and adapt those new and emerging technologies that have the potential to improve the economics of recovering oil from Eastern oil shales. The technologies evaluated in this program can be grouped into three areas: fine grinding kerogen/mineral matter separation, and waste treatment and disposal. Four subtasks were defined in the area of fine grinding. They were as follows: Ultrasonic Grinding, Pressure Cycle Comminution, Stirred Ball Mill Grinding, and Grinding Circuit Optimization. The planned Ultrasonic grinding research was terminated when the company that had contracted to do the research failed. Three technologies for effecting a separation of kerogen from its associated mineral matter were evaluated: column flotation, the air-sparged hydrocyclone, and the LICADO process. Column flotation proved to be the most effective means of making the kerogen/mineral matter separation. No problems are expected in the disposal of oil shale tailings. It is assumed that the tailings will be placed in a sealed pond and the water recycled to the plant as is the normal practice. It may be advantageous, however, to conduct further research on the recovery of metals as by-products and to assess the market for tailings as an ingredient in cement making.

153 **Process for the selective conversion of the asphaltenes in bitumen upgrading.** Smith, K.J.; Ng, C. 11 Jul 1992. Filed date 10 Jan 1991. Canada Patent patent application 2033965. 17p. Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN.

A process is provided for selectively converting the asphaltenic fraction of a bitumen feedstock to lower boiling point distillates. According to the invention, the bitumen feedstock is reacted with hydrogen under hydrocracking conditions in the presence of a metal hydrotreating catalyst on a delaminated pillared clay catalyst support. The reaction temperature is preferably 430-450°C and the catalyst is selected from the group comprising Co, Mo, Ni, Fe, or W, or mixtures thereof. The catalyst support is prepared from smectite clays, preferably bentonite. Suitable pillaring agents include Al, Cr, Zr, Fe, Ga, or Ti. The catalyst support is characterized by having a bimodal pore size distribution in which at least 40% of the total volume resides in pores having an average diameter > 50 nm and at least 20% of the pore volume resides in pores having an average diameter < 2 nm. Experiments are described to illustrate the process of the invention. 7 tabs.

154 **Use of two or more nested apertured endless belts with inverted arch bottom flights and generally horizontal top flights to recover bitumen and minerals.** Kruyer, J. 28 Jun 1992. Filed date 27 Dec 1990. Canada Patent patent application 2033217. 83p. Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN.

A process and apparatus for the recovery of bitumen and bitumen-wetted minerals from separating mixtures of bitumen, bitumen-wetted minerals, water, and water-wetted minerals uses two or more nested apertured endless belts on conveyor supports that support these belts to form top flights approaching generally horizontal paths above the separating mixture and bottom flights in the form of or approaching inverted arches immersed in the separating mixture. Bitumen separates from a mixture, is captured by and adheres to belt surfaces as the mixture passes through bottom flight apertures, and is conveyed to corresponding top flights where it falls off into receptacles and/or is washed off with water. Mixture that has passed through apertures of the bottom flight of a first belt may be passed through apertures of the bottom flight of a second belt, nested with the first belt, for additional bitumen capture, or is removed. Bitumen washed off with water from the top flights of a first and/or second belt is removed for further processing or is passed to an inside enclosure that contains a third belt, nested with the first and/or second belts, to yield a final bitumen product that is low in hydrophilic minerals. Alternatively, the mixture may be introduced into the volume between the bottom flights of two nested belts and flow through the apertures of both bottom flights simultaneously. 13 figs.

0405 Properties and Composition

Refer also to citation(s) 138

0407 Health and Safety

Refer also to citation(s) 1554

0409 Waste Management

Refer also to citation(s) 150, 152

05 NUCLEAR FUELS

Refer also to citation(s) 1128

0504 Feed Processing

155 (INFO–0386) **An evaluation of the dissolution process of natural uranium ore as an analogue of nuclear fuel.** Stern, V.H. Atomic Energy Control Board, Ottawa, ON (Canada). Aug 1991. 52p. Project 5.139.1. Order Number DE93603216. Source: OSTI; NTIS (US Sales Only); INIS.

The assumption of congruent dissolution of uraninite as a mechanism for the dissolution behaviour of spent fuel was critically examined with regard to the fate of toxic radionuclides. The fission and daughter products of uranium are typically present in spent unreprocessed fuel rods in trace abundances. The principles of trace element geochemistry were applied in assessing the behaviour of these radionuclides during fluid/solid interactions. It is shown that the behaviour of radionuclides in trace abundances that reside in the crystal structure can be better predicted from the ionic properties of these nuclides rather than from assuming that they are controlled by the dissolution of uraninite. Geochemical evidence from natural uranium ore deposits (Athabasca Basin, Northern Territories of Australia, Oklo) suggests that in most cases the toxic radionuclides are released from uraninite in amounts that are independent of the solution behaviour of uranium oxide. Only those elements that have ionic and thus chemical properties similar to U^{4+}, such as plutonium, americium, cadmium, neptunium and thorium can be satisfactorily modelled by the solution properties of uranium dioxide and then only if the environment is reducing. (84 refs., 7 tabs.).

0505 Uranium Enrichment

156 (INIS-BR–2933, pp. 267) **Observation of two photon absorption by optogalvanic detection in a bulb of uranium hollow cathode.** Destro, M.G. (Centro Tecnico Aeroespacial (CTA-IEAv), Sao Jose dos Campos, SP (Brazil). Inst. de Estudos Avancados); Ghizoni, C.C.; Lima, W. de. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. LASER ISOTOPE SEPARATION/hollow cathodes; ABSORPTION; ENERGY SPECTRA; PHOTONS; URANIUM ISOTOPES

157 (KAERI/RR–1007/91) **Development of nuclear fuel. Development of laser spectroscopic technology in nuclear industry.** Lee, Jong Min (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Cha, Hyung Ki; Kim, Chul Jung. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Apr 1991. 197p. (In Korean). Order Number DE93605650. Source: OSTI; NTIS (US Sales Only); INIS.

The goal of the project is to establish database of the spectroscopic parameters of heavy atomic elements by using RIS technology. To achieve the maximum efficiency of photoionization processes, several lasers were used and some equipment which need be according to the experimental purposes were self-constructed: that is, a real time TOF mass spectrometer and a frequency stabilizer for a pulsed dye laser were devised. Multistep photoionization experiments of Hg atoms were carried out with these equipments. Also computer code, MCDF, was executed for the calculation of transition probabilities of Hg atoms. (Author).

0507 Fuels Production and Properties

Refer also to citation(s) 625, 627, 637, 638, 639, 640, 641, 642, 643, 644, 645, 647, 648, 649, 651, 652, 666, 1024, 1043, 1146

158 (AECL–10438) **Fission-product releases from UO_2 in air and inert conditions at 1700-2350 K: Analysis of the MCE-1 experiment.** Cox, D.S. (Atomic Energy of Canada Ltd., Chalk River, ON (Canada). Chalk River Nuclear Labs.); Hunt, C.E.L.; Liu, Z.; Keller, N.A.; Barrand, R.D.; O'Connor, R.F.; Iglesias, F.C. Atomic Energy of Canada Ltd., Chalk River, ON (Canada). Chalk River Nuclear Labs. Jul 1991. 23p. (CONF-910714–: International topical meeting on safety of thermal reactors, Portland, OR (United States), 21-25 Jul 1991). Order Number DE93603814. Source: OSTI; NTIS (US Sales Only); INIS.

The kinetics of fission-product releases from UO_2 were measured in inert and oxidizing conditions during an in-cell post-irradiation annealing experiment. Eight individual tests were performed using irradiated UO_2 heated in a mixture of argon/2% hydrogen to a maximum temperature of between 1975 and 2350 K, followed by annealing for 25 minutes, then cooling. In some of the tests, the UO_2 was exposed to air for 15 minutes during the annealing period. By changing from inert to oxidizing conditions,

the release rates of I, Cs, Ru and Nb were increased. In oxidizing conditions, Ru was released more rapidly than I or Cs. High rates of UO_2 volatilization occurred in the oxidizing tests, and resulted in greater than 50% release of the low-volatility Zr, La and Ce fission products. Above about 2200 K, significant released of Ba were observed, in both oxidizing and inert conditions. Effective diffusion coefficients for I, Cs and Ba are reported and small but measurable differences in Cs-134 versus Cs-137 behaviour are discussed. Calculations using the CORSOR-M model were in reasonable agreement with the measured kinetics of I and Cs release, but Ba releases were significantly underpredicted at temperatures above 2200 K. (15 refs., 14 figs., tab.).

159 (ARH–1109-Del.) **200 Areas operation monthly report, October 1969.** Atlantic Richfield Hanford Co., Richland, WA (United States). 21 Nov 1969. 51p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE92040915. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report presents significant achievements made during October 1969 in the Manufacturing Department, Research and Development Department, Operations Support Engineering Department, Facilities Engineering Department, Finance Department, and the Industrial Relations Department.(JDB)

160 (ARH–1111-Del.) **200 Areas operation monthly report, December 1969.** Atlantic Richfield Hanford Co., Richland, WA (United States). 21 Jan 1970. 53p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE92040916. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report presents significant achievements made during December 1969 in the Manufacturing Department, Research and Development Department, Operations Support Engineering Department, Facilities Engineering Department, Finance Department, and the Industrial Relations Department.(JDB)

161 (ARH–1501-Del.) **200 Areas operation monthly report, January 1970.** Atlantic Richfield Hanford Co., Richland, WA (United States). 24 Feb 1970. 48p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE92040917. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report presents significant achievements made during January 1970 in the Manufacturing Department, Research and Development Department, Operations Support Engineering Department, Facilities Engineering Department, Finance Department, and the Industrial Relations Department.(JDB)

162 (ARH–1507-Del.) **200 Areas operation monthly report, July 1970.** Atlantic Richfield Hanford Co., Richland, WA (United States). 20 Aug 1970. 51p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE92040919. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report presents significant achievements made during July 1970 in the Manufacturing Department, Research and Development Department, Operations Support Engineering Department, Facilities Engineering Department, Finance Department, and the Industrial Relations Department.(JDB)

163 (ARH–1510-Del.) **200 Areas operation monthly report, October 1970.** Atlantic Richfield Hanford Co., Richland, WA (United States). 23 Nov 1970. 61p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE92040920. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report presents significant achievements made during October 1970 in the Manufacturing Department, Research and Development Department, Operations Support Engineering Department, Facilities Engineering Department, Finance Department, and the Industrial Relations Department.(JDB)

164 (ARH–1904-Del.) **200 Areas operation monthly report, April 1971.** Atlantic Richfield Hanford Co., Richland, WA (United States). 21 May 1971. 56p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE92040921. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report presents significant achievements made during April 1971 in the Manufacturing Department, Research and Development Department, Operations Support Engineering Department, Facilities Engineering Department, Finance Department, and the Industrial Relations Department.(JDB)

165 (DPW–5570) **[Letter to Curtis A. Nelson detailing uranium requirements for R and D].** Squires, L. Du Pont de Nemours (E.I.) and Co., Wilmington, DE (United States). Explosives Dept. 6 Jun 1952. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-76SR00001. (SR/H–238). Order Number DE93001915. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report discusses the uranium requirements for research and development associated with the Savannah River program until the end of 1953. (JL)

166 (DPW–5615) **Uranium experimental program heat treatment.** Hobert, R.H. Du Pont de Nemours (E.I.) and Co., Wilmington, DE (United States). Explosives Dept. 11 Jun 1952. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-76SR00001. (SR/H–199). Order Number DE93000660. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This memorandum discusses an experimental batch of uranium allocated for heat treatment studies. The memo is dated June 11, 1952.(JL)

167 (DPW–5716) **New fuel element development report of meeting, June 23, 1952.** Huntoon, R.T. Du Pont de Nemours (E.I.) and Co., Wilmington, DE (United States). Explosives Dept. 24 Jun 1952. 2p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-76SR00001. (SR/H–204). Order Number DE93000665. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This memorandum summarizes the development of new fuel elements at the Savannah River Plant. Sheathing and alloy development are the focus. The memo is dated June 23, 1952.

168 (DPW–5717) **New fuel element development, alloy development: Trip report, BMI, June 19, 1952.** Huntoon, R.T. Du Pont de Nemours (E.I.) and Co., Wilmington, DE (United States). Explosives Dept. 24 Jun 1952. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-76SR00001. (SR/H–205). Order Number DE93000666. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This memorandum discusses the development of alloys for new fuel elements being fabricated at the Savannah River Plant. Corrosion studies and fabrication techniques are summarized. The memorandum is dated June 19, 1952.

169 (DPW–5718) **New fuel element development report of meeting, June 16, 1952.** Huntoon, R.T. Du Pont de Nemours (E.I.) and Co., Wilmington, DE (United States). Explosives Dept. 23 Jun 1952. 2p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-76SR00001. (SR/H–206). Order Number DE93000667. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This memorandum summarizes the development of new fuel elements at the Savannah River Plant. Corrosion, alloy development and future pile design are discussed. The memo is dated June 23, 1952.

170 (DPW–5863) **Trip report: Argonne National Laboratory, June 25, 1952.** Montenyohl, V.I. Du Pont de Nemours (E.I.) and Co., Wilmington, DE (United States). Explosives Dept. 16 Jul 1952. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-76SR00001. (SR/H–208). Order Number DE93001235. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The specimens of uranium plate from Los Alamos in as-received condition corroded at the rate of about 4.9 mg/cm^2hr in boiling distilled water of high resistivity. The corrosion rates of identical specimens which had been beta-treated was somewhat less but erratic.

171 (DPW–5915) **Comments on Oak Ridge examination of irradiated thorium.** Hayes, E.E.; Montenyohl, V.I. Du Pont de Nemours (E.I.) and Co., Wilmington, DE (United States). 21 Jul

1952. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-76SR00001. (SR/H–213). Order Number DE93001240. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This memorandum discusses the examination of irradiated thorium by Oak Ridge. Topics addressed include: Number of slugs, history of thorium used, irradiation data, and dimensional measurements. (JL)

172 (DPW–5921) **Trip report: Hanford, June 23–24, 1952.** Woodhouse, J.C. Du Pont de Nemours (E.I.) and Co., Wilmington, DE (United States). Explosives Dept. 28 Jul 1952. 2p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-76SR00001. (SR/H–214). Order Number DE93001241. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This memorandum discusses a trip made to Hanford on June 23 and 24, 1952 concerning the irradiation of thorium, material and canning problems, nondestructive testing, and slug failures. (JL)

173 (GEH–18818) **Dissolve – silver reactor temperature requirements.** Evans, L.C. Du Pont de Nemours (E.I.) and Co., Wilmington, DE (United States). Explosives Dept. 29 Aug 1951. 2p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (DPW–3122). Order Number DE93000321. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Short communication. HANFORD PRODUCTION REACTORS; DISSOLVERS/temperature control; NUCLEAR FUELS; DISSOLVERS; PROCESS CONTROL; SEPARATION PROCESSES

174 (KAERI/RR–1056/91) **High density UO_2 powder preparation for HWR fuel.** Hwang, S. T. (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Chang, I. S.; Choi, Y. D.; Cho, B. R.; Kwon, S. W.; Kim, B. H.; Moon, B. H.; Kim, S. D.; Phyu, K. M.; Lee, K. A. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Jan 1992. 60p. (In Korean). Order Number DE93605763. Source: OSTI; NTIS (US Sales Only); INIS.

The objective of this project is to study on the preparation of method high density UO_2 powder for HWR Fuel. Accordingly, it is necessary to character ize the AUC processed UO_2 powder and to search method for the preparation of high density UO_2 powder for HWR Fuel. Therefore, it is expected that the results of this study can effect the producing of AUC processed UO_2 powder having sinterability. (Author).

0508 Spent Fuels Reprocessing

Refer also to citation(s) 155, 171, 650, 1133, 1148, 1188, 1207

175 (ARH–61-Del.) **200 Areas operation monthly report, November 1967.** Atlantic Richfield Hanford Co., Richland, WA (United States). 22 Dec 1967. 45p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE92019773. Source: OSTI; NTIS (US Sales Only); GPO Dep.

CPD manufacturing plants operated satisfactorily. Production of all products met all forecasts, despite the N-Reactor strike. Blending and casting of Pu ingots for ZPPR resumed on Nov. 20. Both 242-T Waste Evaporator and In-Tank Solidifcation unit performed well. Testing of Phase III equipment at B Plant continued. The Cell 23 waste concentrator at B Plant evaporated 591,000 gal waste, despite outages. Decontamination of Semiworks is almost complete. 106,000 Ci of cesium-137 was shipped to ORNL. 1.3 MCi of cerium-144 was recovered from Purex high-level waste and shipped to Battelle-Northwest. 241 g Pu-238 was processed to the oxide and shipped to Miamisburg. The prototype scrubber humidifier has operated satisfactorily in a test in the off-gas train of the No. 1 In-Tank Solidification unit. Light Th oxide pellets have been produced for target elements. Training of chemical operators began Nov. 1. (DLC)

176 (ARH–303-Del.) **200 Areas operation monthly report, April 1968.** Atlantic Richfield Hanford Co., Richland, WA (United States). 22 May 1968. 49p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE92040629. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Operation of 200 Area production facilities was satisfactory; Pu and U product outputs met or exceeded April requirements. Purex processing of N-Reactor coproduct blend was completed; processing of normal U fuels containing nondefense grade Pu was started. 94-210 UNH feed from Purex was calcined in Uranium Oxide Plant; calcination was started on normal depleted UNH feed. The Pu processing facility operated on defense grade Pu feed through April 19; the system was then cleaned out for non-defense Pu button production. Operations in Pu recovery facilities were hampered. Blending and casting of Pu ingots for ZPPR continued. Solvent extraction of Purex current acid waste in B Plant resulted in Sr recoveries of 90-95%. 1.4 MCi of cesium-137 were added to storage from the B Plant cesium ion exchange processing of supernate waste. In-tank solidification units No. 1 and 2 had on-line efficiencies of 77 and 93%. The 242-T waste evaporator was shut down April 23 for maintenance. Two casks, each loaded with I.5 MCi cerium-144, were shipped. Causes of exothermic reactions during processing of high-exposure, long-cooled N-Reactor fuels are being studied. Cd nitrate is being tested as neutron poison in Purex Plant. A process test was conducted in Reclamation facility for Pu recovery and partitioning from mixed U-Pu scrap. (DLC)

177 (ARH–305-Del.) **200 Areas operation monthly report, June 1968.** Atlantic Richfield Hanford Co., Richland, WA (United States). 22 Jul 1968. 47p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE92040630. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Operation of 200 Areas production facilities was satisfactory; Pu and U product output exceeded schedules. Purex processing of normal U containing defense grade Pu was completed and a planned outage started. Uranium Oxide plant performed well, processing normal depleted UNH feed. Operations in the Pu recovery and processing facilities were also satisfactory,as were waste management activities at B plant. The 2nd campaign for processing Purex current acid waste by solvent extraction was started. In June, 107,000 gal supernate waste were processed in the B Plant cesium ion exchange unit. The 242-T waste evaporator performed well. The immersion heater shorted out in in-tank solidification unit No. 1 June 13. ITS-2 was shut down June 26. Casks of sulfate-free waste were shipped to Battelle-Northwest; waste casks were received from there and sent to underground storage. The HS scrub column in Purex first decontamination and partition cycle was bypassed in preparation for removal. Contents are being removed from Tank 241-A-105 which has a bulged liner. 6 g Rh was shipped. Training and testing of the first generation of Lead Nuclear Chemical Operator candidates was completed. (DLC)

178 (ARH–1101-Del.) **200 Areas operation monthly report, February 1969.** Atlantic Richfield Hanford Co., Richland, WA (United States). 21 Mar 1969. 46p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE92040631. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Although Feb. was a low-volume production month, deliveries met schedule. Processing of high Pu-240 grade Pu in Purex plant was completed. After turnaround, processing of low-pressure reactor Al-clad U containing fuel-grade Pu was started. Operations in Pu processing and recovery facilities had a few outages. Removal of Tank 241-AX-101 as the B Plant fractionation waste receiver on Jan. 26 required expediting several special activities. More than 2,800 kCi cesium 137 were removed from 333,000 gal aged supernatant waste feed. Total space recovered in the tank farm by Redox evaporators, ITS-1, ITS-2, and 242-T was 1,164,000 gal (total for FY 1969 8,343,000 gal). 1,200 g Np were calcined and shipped. 28 kCi Sr-90 was shipped. A project proposes to provide a 7500 ft deep well for feasibility study of radwaste storage in deep basalt caverns under Hanford. (DLC)

179 (ARH–1103-Del.) **200 Areas operation monthly report, April 1969.** Atlantic Richfield Hanford Co., Richland, WA (United States). 22 May 1969. 55p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE92040632. Source: OSTI; NTIS (US Sales Only); GPO Dep.

April output of Pu and U products was slightly below forecast, owing to Purex outage extension. The 4th coproduct blend processing campaign was started in Purex plant April 14; processing of final coproduct material from N Reactor proceeded smoothly.

Transfer of stored, depleted natural U oxide to Paducah KY was started. Operations in Pu processing and recovery facilities were satisfactory. At B Plant, solvent extraction processing of Purex current acid waste (CAW) was resumed; routine removal of Cs from CAW was begun. Ion Exchange processing was interrupted in B Plant to replace the zeolite bed. Total space recovered by Redox evaporators and by ITS-1, ITS-2 and 242-T was 1,307,000 gal during this month. The exploratory well for feasibility of radwaste storage reached a depth of 364 ft. (DLC)

180 (ARH–1104-Del.) **200 Areas operation monthly report, May 1969.** Atlantic Richfield Hanford Co., Richland, WA (United States). 23 Jun 1969. 49p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE92040633. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Operation of Area 200 production facilities was satisfactory; major product output schedules were met or exceeded. Final chemical processing activities in support of the N Reactor coproduct demonstration program were completed; processing and blending the enriched U was successful. Transfer of stored, depleted natural U oxide to Paducah KY accelerated. The Pu reclamation facility operated without interruption, on weapons-grade Pu scrap. Waste management activities at B Plant were satisfactory. Operation of the B Plant Cs ion exchange unit was resumed after the zeolite bed replacment; a record processing rate of 200,000 gal of aged supernatant waste feed was achieved. Total space recovered in the tank farm was 1,444,000 gal for the month; a record total boiloff was achieved for the second consecutive month. Sluicing of sludge in Tank 241-104-A to Tank 241-106-A was started. Annual audit and review of the nuclear criticality control program was completed. (DLC)

181 (ARH–1105-Del.) **200 Areas operation monthly report, June 1969.** Atlantic Richfield Hanford Co., Richland, WA (United States). 23 Jul 1969. 48p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE92040634. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The first cycle waste concentrator was discovered to be leaking in Purex plant; the outage was extended. The U oxide plant completed calcining the last of coproduct 210-94 blend material. Transfer of stored depleted natural U oxide to KY was completed. Operations in Pu processing and reclamation facilities were satisfactory. At B plant, solvent extraction processing of Purex CAW was conducted June 9–23; 5 mCi cerium-144 were segregated from the acid waste. The cesium ion exchange unit perfomed better since the column zeolite bed was replaced. The PTA (phosphotungstic acid) process for Cs removal from CAW resulted in low Cs recovery. Operations in waste tank space recovery program continued. 300 kCi cobalt-60 in discarded shroud tubes were disposed of. Hot water were used to try to soften the sludge in Tank 241-104-A. The exploratory well reached a depth of 3,365 ft. (DLC)

182 (ARH–1502-Del.) **200 Areas operation monthly report, February 1970.** Atlantic Richfield Hanford Co., Richland, WA (United States). 24 Mar 1970. 46p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE92040918. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This was a low-volume production month. Processing of weapons-grade Pu in Purex was completed Feb. 5, and dissolution of PRTR fuels was started on Feb. 26. The enriched U oxide powder produced in the U Oxide Plant was milled and loaded for shipment to Fernald. Operations in the Pu processing facility were limited to about 1 week owing to lack of feed; weapons-grade Pu metal was produced. The weapons-grade Pu recovered in the Pu reclamation facility exceeded specified P and Si contents; it will be reprocessed. A process test on the reburning of incinerator ash was completed, with a 36% reduction in ash weight. The Cs ion exchange unit was out of service most of the month in B Plant. The 1st solvent extraction campaign to process PAS from the sulfate precipitation head-end process was completed, with >95% of the Sr removed from 11,000 gal. The 2nd CY 1970 solvent extraction campaign for Purex CAW was interrupted for a week. Boiloff rates at 242-T evaporator were limited to about 60% capacity; total space recovered by Redox evaporators and ITSs-1, ITS-2 and 242-T was 851,000 gal in Feb. (DLC)

183 (ARH–1905-Del.) **200 Areas operation monthly report, May 1971.** Atlantic Richfield Hanford Co., Richland, WA (United States). 18 Jun 1971. 54p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE92040922. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Operation of production facilities in 200 Areas were satisfactory; major product output schedules were met. The 3A feed pump failed and was replaced in Purex plant during processing of Al-clad natural U; the 2nd U cycle equipment was flushed as well; and processing was resumed May 13. The U Oxide Plant resumed calcining operations May 4; hoppers were filled with milled U oxide powder. The Pu processing and reclamation facilities operated the entire month, producing and recovering weapons-grade Pu. Solvent extraction processing of Purex CAW in B Plant was completed May 23; about 2.9 MCi Pm-147 and 18.8 MCi Ce-144/Pr were collected. 395,000 gal Redox waste supernatants from 241-SX tank farm were processed and 710kCi Cs-137 added to product storage. ITS-2 was out of service while excess solids was removed from the tank. Total space recovered by Redox evaporators and ITS-1, ITS-2 and 242-T was 618,000 gal, bringing the total for FY 1971 to 11,404,000 gal. The HAPO 1B-1 cask, loaded with 600 kCi Sr-90, was released for shipment to ORNL. The Tank Farm Management Subsection and the projected Encapsulation facility were realigned under Purex management; the new section is designated as the Purex, Waste Encapsulation and Solidification section. (DLC)

184 (BARC–1991/E/002) **Analytical techniques for in-line/on-line monitoring of uranium and plutonium in process solutions : a brief literature survey.** Marathe, S.G. (Bhabha Atomic Research Centre, Bombay (India). Fuel Chemistry Div.); Sood, D.D. Bhabha Atomic Research Centre, Bombay (India). 1991. 35p. Order Number DE93605258. Source: OSTI; NTIS (US Sales Only); INIS.

In-line/on-line monitoring of various parameters such as uranium-plutonium-fission product concentration, acidity, density etc. plays an important role in quickly understanding the efficiency of processes in a reprocessing plant. Efforts in studying and installation of such analytical instruments are going on since more than three decades with adaptation of newer methods and technologies. A review on the developement of in-line analytical instrumentation was carried out in this laboratory about two decades ago. This report presents a very short literature survey of the work in the last two decades. The report includes an outline of principles of the main techniques employed in the in-line/on-line monitoring. (author). 77 refs., 6 tabs.

185 (BARC–1991/E/018) **Studies on resin degradation products encountered during purification of plutonium by anion exchange.** Ramanujam, A. (Bhabha Atomic Research Centre, Bombay (India). Fuel Reprocessing Div.); Dhami, P.S.; Gopalakrishnan, V.; Dhumwad, R.K. Bhabha Atomic Research Centre, Bombay (India). 1991. 29p. Order Number DE93605259. Source: OSTI; NTIS (US Sales Only); INIS.

Among the methods available for the purification of plutonium in Purex process, anion exchange method offers several advantages. However, on repeated use, the resin gets degraded due to thermal, radiolytic and chemical attacks resulting in chemical as well as physical damage. Frequently, plutonium product eluted from such resin contains significant quantities of white precipitates. A few anion exchange resins were leached with 8 M HNO_3 at 60-80degC and the resin degradation products (RDP) in the leach-extract were found to give similar precipitates with tetravalent metal ions like Pu(IV), Th(IV) etc. Tetra propyl ammonium hydroxide in 8 M HNO_3 (TPAN) also gave a white precipitate with plutonium similar to the one found in the elution streams. The results indicate that delinked quaternary ammonium functional groups might be responsible for the formation of precipitate. The characteristics of precipitates Th-RDP, Th-TPAN and that isolated from elution stream have been investigated. In a separate study a tentative formula for Th-RDP compound is proposed. The influence of RDP on the extraction of plutonium and other components in Purex process was studied and it was found that RDP complexes metal ions thus

marginally affecting the kd values. A spectrophotometric method has been standardised to monitor the extent of degradation of anion exchange resins which is based on the ability of RDP to reduce the colour intensity of Th-thoron complex. This technique can be used to study the stability of the anion exchange resins. (author). 8 refs., 8 tabs., 5 figs.

186 (BARC–1992/E/002) **Role of ion transfer membrane in the production of uranous nitrate.** Nair, M.K.T. (Bhabha Atomic Research Centre, Tarapur (India). PREFRE Plant); Singh, R.K.; Bajpai, D.D.; Venugopalan, A.K.; Singh, R.R.; Gurba, P.B.; Thomas, Mathew. Bhabha Atomic Research Centre, Bombay (India). 1992. 41p. Order Number DE93605260. Source: OSTI; NTIS (US Sales Only); INIS.

In Purex process, plutonium and uranium are co-extracted into organic phase and these are partitioned by reducing Pu(IV) to Pu(III) using hydrazine stabilized uranous nitrate solution. Usually, uranous nitrate is added in much higher quantity than the stoichiometric requirement to effect complete reduction of plutonium. In conventional electrolytic cells only 60 to 70% of uranyl to uranous conversion is achieved. Use of this solution results in dilution of plutonium product. In addition to this, each externally fed uranous nitrate batch increases uranium processing load and affects the plant throughput. In order to keep the additional uranium processing load to a minimum, it is necessary to increase the uranous content to near cent percent level in the externally fed uranous nitrate solution. The studies carried out at PREFRE (Power Reactor Fuel Reprocessing) laboratory have shown that it is possible to produce concentrated uranous nitrate solution, nearly free from uranyl nitrate, by using a cation exchange membrane. This paper describes the development work carried out at PREFRE plant, Tarapur for production of cent percent uranous nitrate solution. Development of electrolytic cells for uranous production, from laboratory scale to pilot plant scale, has been explained. (author). 24 refs., 8 figs., 8 tabs.

187 (BARC–1992/E/009) **Extraction of actinides from high level waste streams of Purex process using mixtures of CMPO and TBP in dodecane.** Mathur, J.N. (Bhabha Atomic Research Centre, Bombay (India). Radiochemistry Div.); Murali, M.S.; Natarajan, P.R. Bhabha Atomic Research Centre, Bombay (India). 1992. 31p. Order Number DE93605261. Source: OSTI; NTIS (US Sales Only); INIS.

The extraction of actinides from high-active aqueous raffinate waste (HAW) as well as high level waste (HLW) solutions arising from Purex processing of thermal reactor fuels has been studied using a mixture of octyl(phenyl)-N, N-diisobutylcarbamoylmethylphosphine oxide (CMPO) and TBP in dodecane. The results on the extraction and striping of actinides, lanthanides and other fission products have been discussed in this report and optimum conditions have been proposed for the efficient recovery of residual actinides from HAW and HLW streams by CMPO extraction and for their selective stripping with suitable reagents. Experiments on the extraction and separation of actinides and lanthanides by CMPO in the presence of TBP in dodecane have also been carried out with U(VI) and Nd(III) to arrive at the limiting conditions for avoiding third phase formation. (author). 18 refs., 5 figs., 10 tabs.

188 (CEA-CONF–10979) **Diamides as actinides extractants for various wastes treatment.** Cuillerdier, C.; Musikas, C.; Nigond, L. CEA Centre d'Etudes de la Vallee du Rhone, 30 - Marcoule (France). Dept. des Procedes de Retraitement. 1991. 25p. (CONF-911049–: 7. symposium on separation science and technology for energy applications, Knoxville, TN (United States), 20-24 Oct 1991). Order Number DE93721041. Source: OSTI; NTIS (US Sales Only); INIS.

Substituted propanediamides were studied at Fontenay-aux-Roses for the declassification of nuclear liquid wastes by extraction of all the actinides. Their synthesis has been improved. By optimization of the formula, it is possible to use aliphatic diluents without third phase formation in contact with nitric acid at 20 deg C. Addition of oxalic acid allows separation of iron and zirconium from americium and plutonium. In selected conditions, it appears that americium extraction is faster than iron extraction which could lead to practical applications. Recent studies have shown that diamides can be used to remove the actinides from waste solutions in chloride medium coming from defense facilities. The current knowledge and the projects for using diamides as actinides extractants will be reviewed.

189 (CEA-CONF–10982) **Picolinamides, a possible family of actinide extractants, for the one step actinide (VI), (IV) and (III) separation from the spent nuclear fuels dissolution liquors.** Musikas, C.; Cuillerdier, C.; Coutin, C. CEA Centre d'Etudes de la Vallee du Rhone, 30 - Marcoule (France). Dept. des Procedes de Retraitement. 1992. 3p. (CONF-9204201–: 22. Meeting Actinides, Meribel (France), 22-25 Apr 1992). Order Number DE93721044. Source: OSTI; NTIS (US Sales Only); INIS.

The separation of all the actinides U, Np, Pu, Am and Cm from the spent fuels and their further transmutation become one alternative to the deep ground repository storage of radioactive wastes. To achieve this aim, new chemical separation processes, more convenient than the PUREX process, are necessary. Especially, extractants able to separate in one single step the actinide (VI), (IV) and (III) from acidic nitrate solutions, leaving the lanthanides (III) in the effluents are highly suitable. Results in the search of such extractants are presented. 1 tab., 6 refs.

190 (CEA-CONF–10985) **Development and implementation of methods for mass and volume measurements in input solutions.** Cauchetier, P.; Lamarque, G. CEA Centre d'Etudes de la Vallee du Rhone, 30 - Marcoule (France). Dept. des Procedes de Retraitement. 1992. 9p. (CONF-9203198–: Tame Lab Meeting, Ispra (Italy), 25-27 Mar 1992). Order Number DE93721046. Source: OSTI; NTIS (US Sales Only); INIS.

Methods for the determination of the mass of material contained in a vessel, in a nuclear environment, are reviewed. Corrections for temperature and homogeneity are discussed for an accurate determination on an industrial scale.

191 (CEA-CONF–10994) **An example of R and D on safety assessment: study of a prolonged loss of cooling of halw (beyond design accident).** Mercier, J.P. (CEA Centre d'Etudes de Fontenay-aux-Roses, 92 (France). Inst. de Protection et de Surete Nucleaire); Bonneval, F.; Martineau, D.; Gue, J.P.; Philippe, M. CEA Centre d'Etudes de la Vallee du Rhone, 30 - Marcoule (France). Dept. des Procedes de Retraitement. 1991. 25p. (CONF-9110434–: OECD/NEA/CSNI Specialist Meeting on Safety and Risk Assessment in Fuel Cycle Facilities, Tokyo (Japan), 7-9 Oct 1991). Order Number DE93721103. Source: OSTI; NTIS (US Sales Only); INIS.

The consequences of a loss of cooling of storage tanks of fission products concentrated solutions were studied, for a variable period, in the context, of the safety analysis of the COGEMA spent fuel reprocessing plants of La Hague. As a result of fission products-induced heat emission, a prolonger loss of cooling could involve the progressive evaporation of solutions up to dryout and lead to the formation of radioactive aerosols and then of volatile species of ruthenium likely to be released in off gas circuits of the tanks. With the aim of determining the radioactivitiy fraction likely to be transferred throughout the loss of cooling out of the storage tanks, an extensive R and D programme was performed, including the main following stages: - experimental determination of the factor of radioactivity transfer through aerosols out of the tanks; - modelling, by means of a calculation code, of the aerosols transfer into the off gas circuits; - experimental study of the ruthenium behaviour with tests carried out in laboratory, by evaporation of samples representative of nitric solutions of fission products. The main conclusions can be summarized as follows (by assuming a heat power density of 10 watts per litre of solution and a storage system completely adiabatic): - the evaporation of solutions starts more than 5 hours after the total loss of cooling, the 10^{-4} value being an overestimated value of the factor of radioactivity transfer by aerosols out of the tanks; - transfer factor through the off gas circuits varies, according to the physical characterisitcs of aerosols, from 0 to 8.10^{-2}; - ruthenium volatilizes only during the final stage of evaporation, shortly before dryout; the minimum time to reach dryness is about 90 hours.

192 (CEA-CONF–10995) **Fuel reprocessing: safety analysis of extraction cycles.** Dinh, B. (CEA Centre d'Etudes de la Vallee du Rhone, 30 - Marcoule (France). Direction du Cycle du Combustible); Mauborgne, B.; Baron, P.; Mercier, J.P. CEA Centre d'Etudes de la Vallee du Rhone, 30 - Marcoule (France). Dept. des Procedes de Retraitement. 1991. 6p. (CONF-9110434–: OECD/NEA/CSNI Specialist Meeting on Safety and Risk Assessment in Fuel Cycle Facilities, Tokyo (Japan), 7-9 Oct 1991). Order Number DE93721104. Source: OSTI; NTIS (US Sales Only); INIS.

An essential part of the safety analysis related to the extraction cycles of reprocessing plants, is the analysis of their behaviour during steady-state and transient operations, by means of simulation codes. These codes are based on the chemical properties of the main species involved (distribution coefficient and kinetics) and the hydrodynamics inside the contactors (mixer-settlers and pulsed columns). These codes have been consolidated by comparison of calculations with experimental results. The safety analysis is essentially performed in two steps. The first step is a parametric sensivity analysis of the chemical flowsheet operated: the effect of a misadjustment (flowrate of feed, solvent, etc) is evaluated by successive steady-state calculations. These calculations help the identification of the sensitive parameters for the risk of plutonium accumulation, while indicating the permissible level of misadjustment. These calculations also serve to identify the parameters which should be measured during plant operation. The second step is the study of transient regimes, for the most sensitive parameters related to plutonium accumulation risk. The aim is to confirm the conclusions of the first step and to check that the characteristic process parameters chosen effectively allow, the early and reliable detection of any drift towards a plutonium accumulating regime. The procedures to drive the process backwards to a specified convenient steady-state regime from a drifting-state are also verified. The identification of the sensitive parameters, the process status parameters and the process transient analysis, allow a good control of process operation. This procedure, applied to the first purification cycle of COGEMA's UP3-A La Hague plant has demonstrated the total safety of facility operations.

193 (DPW–5360) **[Ion exchange coupling and slag and crucible dissolving]: Trip report to ORNL, April 29, 1952.** Barber, J.R. Du Pont de Nemours (E.I.) and Co., Wilmington, DE (United States). Explosives Dept. 13 May 1952. 2p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-76SR00001. (SR/H–217). Order Number DE93001244. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report discusses the ion exchange coupling and slag and crucible dissolving. The report is dated April 29, 1952. (JL)

194 (DPW–5373) **U-237 in recovered uranium.** Arnett, L.M. Du Pont de Nemours (E.I.) and Co., Wilmington, DE (United States). Explosives Dept. 14 May 1952. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-76SR00001. (SR/H–219). Order Number DE93001246. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report discusses the radiation hazard U 237 presents in exposed fuel during uranium recovery from the Purex process. The report is dated May 14, 1952.

195 (DPW–5380) **Project 8980: Savannah River Plant, separations, 200 Area, 221 Bldg., "B" line, waste recovery, dissolving.** Barber, J.R. Du Pont de Nemours (E.I.) and Co., Wilmington, DE (United States). Explosives Dept. 15 May 1952. 2p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-76SR00001. (SR/H–220). Order Number DE93001247. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This memorandum comments on the review of the flow diagram for Pu waste recovery dissolving. The memo is dated May 15, 1952.(JL)

196 (DPW–5690) **Processing of irradiated thorium.** Chambers, F.S. Du Pont de Nemours (E.I.) and Co., Wilmington, DE (United States). Explosives Dept. 23 Jun 1952. 2p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-76SR00001. (SR/H–201). Order Number DE93000662. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This memorandum discusses the processing of irradiated thorium at the Savannah River Plant during June, 1952. The design and development of facilities for processing irradiated thorium are discussed.

197 (DPW–5864) **Trip report: Thorium meeting, Division of Research, AEC, Washington, DC, May 7, 1952.** Hayes, E.E. Du Pont de Nemours (E.I.) and Co., Wilmington, DE (United States). Explosives Dept. 16 Jul 1952. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-76SR00001. (SR/H–209). Order Number DE93001236. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report discusses the meeting to review the research on thorium during the past year and to formulate the necessary program for the coming year. The report is dated May 7, 1952.

198 (DPW–6618) **A survey of methods for the determination of tritium.** Schloo, M.; VanNess, M. Du Pont de Nemours (E.I.) and Co., Wilmington, DE (United States). Explosives Dept. 14 Nov 1952. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-76SR00001. (SR/H–197). Order Number DE93000658. Source: OSTI; NTIS (US Sales Only); GPO Dep.

During the course of research and development on the Tritium Project there arose two distinct needs for the determination of tritium in other gases: the separation process where helium is the major component; and samples which are essentially hydrogen. This report discusses the analysis of gases to determine the tritium concentration.

199 (EUR–14363, pp. 111-124) **Pilot dismantling of the AT1 FBR reprocessing facility at La Hague. Phase 1 - Dismantling of dissolution and extraction systems and processing of the arising dismantling waste.** Cornu, F. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Direction du Cycle du Combustible). Commission of the European Communities, Luxembourg (Luxembourg). 1992. (CONF-9109441–: 2. Seminar on practical decommissioning experience with nuclear installations in the European Community, Sellafield (United Kingdom), 25-26 Sep 1991). In *Practical decommissioning experience with nuclear installations in the European Community.* 207p. Order Number DE93721081. Source: OSTI; NTIS (US Sales Only); INIS.

AT was designed and built as a pilot plant for the reprocessing of mixed oxide fuel elements coming from the FBR programme. After ten years of operation the plant was definitively shut down in 1979. Due to the different radionuclides involved, fission products and alpha emitters no advantage will come from delaying the dismantling of the facility. The preliminary studies and preparation of the safety report had begun April 1981. Up to 1985 cleaning operations and building improvement took place while specific equipment was developed. Then, dismantling operations really started in 1985. The work planning, revised in 1989, scheduled the completion of the operations for the end of 1992. Considering that the experience to be gained from the dismantling of the first representative nuclear installations in the Community should be made available to all Member States, the Commission selected AT1 as a pilot dismantling project for the 1989-1993 R and D programme on the decommissioning of nuclear installations.

200 (EUR–14363, pp. 125-148) **Decontamination and dismantling of the PIVER prototype vitrification facility at Marcoule: final results and conclusions.** Jouan, A. (CEA Centre d'Etudes de la Vallee du Rhone, 30 - Marcoule (France). Dept. des Procedes de Retraitement); Deschaud, C.; Roudil, S.; Chauvet, F. Commission of the European Communities, Luxembourg (Luxembourg). 1992. (CONF-9109441–: 2. Seminar on practical decommissioning experience with nuclear installations in the European Community, Sellafield (United Kingdom), 25-26 Sep 1991). In *Practical decommissioning experience with nuclear installations in the European Community.* 207p. Order Number DE93721081. Source: OSTI; NTIS (US Sales Only); INIS.

Decommissioning of the PIVER pilot vitrification facility for fission product solutions is now virtually completed. PIVER was targeted for decommissioning in 1984 and the operation began in 1988 after preliminary work from 1984 to 1987. Dismantling of major process equipment, waste removal, cell decontamination, pipe cutting and disassembly of task-related equipment continued until 1990, first

using telemanipulators, with gradually increasing direct human participation as the ambient dose rates dropped to suitable levels. After decontamination of a few residual irradiation sources, the final operations during 1991 involved experimental R and D to assess a number of final decontamination processes.

201 (HW–34253) **Production Test 221-T-19 reduction of time cycle in dissolver section.** Schmidt, W.C. General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 19 Nov 1954. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93001248. Source: OSTI; NTIS (US Sales Only); GPO Dep.

To determine, by test, the feasibility of decreasing the time requirements to prepare the aluminum clad uranium slugs into uranyl nitrate solution suitable for the separation of plutonium from uranium in the extraction step.

202 (HW–50089-Del.) **Chemical Processing Department monthly report, April 1957.** General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 22 May 1957. 106p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93000771. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Two new production records were set during April, for processed U and Pu production. 0.9 tons sheared NRX fuel were dissolved in Redox. Discrepancies in Pu yield are being studied. Alternate methods of recovering Np are being evaluated. The Purex prototype facility will be converted to the anion exchange process. Alternate designs for a Purex miniature service dissolver were reviewed. The Purex HA column will be replaced.

203 (HW–51211-Del.) **Chemical Processing Department monthly report, June 1957.** General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 22 Jul 1957. 103p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93000772. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Purex and Redox plants operated satisfactorily. Pu production exceeded commitments. The continuous calciners in UO_3 plant experienced difficulty, but the monthly commitment was exceeded. Capital costs for conversion of B plant to recover Cs and Ce have increased. For future processing of E metal, several 3-ton batches were dissolved in Redox. The continuous Task I prototype is being tested for startup of production facilities. Redox product solutions generally have higher waste losses than these from Purex material. The continuous anion exchange prototype will also be tested. Engineering studies were completed of two facets of Purex Phase II expansion, plant conversion to two cycles, and expansion to a rate of 25.8 tons U/day. A proposal requests authority to expand Purex to capacity factor 3.2 along with the two-cycle conversion. The Pu trifluoride process review indicated that conversion to the PuF3 process is not likely. Separations plant dissolver capacity potential for the next 5 yr was studied. (DLC)

204 (HW–53449-Del.) **Chemical Processing Department monthly report, October 1957.** General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 22 Nov 1957. 106p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93000773. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Record highs were set for Pu output in separations plants and for amount of U processed in Purex. UO_3 production and shipments exceeded schedules. Fabrication of 200 and 250 Model assemblies is reported. Unfabricated Pu production was 8.5% short. Nitric acid recovery in Purex and Redox is reported. Prototype anion exchange system for Pu was tested in Purex. Hinged agitator arms with shear pin feature was installed in UO_3 plant H calciner. Operation of continuous type Task I, II facility improved. DBBP is considered for Recuplex. Methods for Pu in product solutions agreed to within 0. 10%. Purex recycle dock shelter is complete. Other projects are reported.

205 (HW–59849-Del.) **Chemical Processing Department monthly report, March 1959.** General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 20 Apr 1959. 72p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93001332. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Production of Pu, UO_3, and Pu metal exceeded forecasts. The 2nd attempt at Purex to recover Zr-Nb resulted in about 1/3 recovery, contaminated with about 1% of the Ce. Palm losses to Purex U product were eliminated, and the Pu content was reduced 5 to 10×. Routing the dissolver rinses into 3WB concentrator resulted into improved rinsing efficiency. Unclarified feed was processed through Purex HA column. In a test for using B in Redox, the B was routed completely to the waste; it was not detectable in product streams beyond the first cycle. Almost 1000 g Palm was purified and converted to oxide. Ferrous ion catalyzed the reduction of Palm VI by hydrazine or semicarbazide. Coordination of E-metal and NPR reprocessing at Redox in multipurpose dissolver was studied. An interim fission product recovery program at Purex will be directed toward low-efficiency collection of Pm^{147}. Locations for critical incident alarms were selected. (DLC)

206 (HW–60236-Del.) **Chemical Processing Department monthly report, April 1959.** General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 21 May 1959. 68p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93001225. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Production of Pu from separations plants was only 58% of April commitment because of Purex difficulties. UO_3 production, shipments met schedules. Pu shape production and shipments exceeded forecast by 14%. Purex HS column, repaired Oct 1958, developed another leak and was bypassed April 18, resulting in Pu and U that required reprocessing. A Palm recovery run at Purex with all- reducing flowsheet, resulted in 87% recovery and excellent decontamination of product. The prototype dual-pass silver reactor in Purex C-cell plugged with offgases. Processing of unclarified feed through Purex solvent extraction continued. Redox dissolver batch sizes for E-metal processing were increased from 1.75 to 2.0 tons. Testing of first extraction cycle acidic flowsheet at Redox continued, with Np losses to HAW being below detection limit. Ru in 1AFS stream increased 10-fold F.P. activity but was removed in acid deficient U cycles. A sulfamic acid process is being explored for dissolving Pu metal. Scope design of Redox dissolver and RMA line replacement at Z plant was completed. Shielding effectiveness of medium and high density x-ray lead glass was compared.

207 (HW–60559-Del.) **Chemical Processing Department monthly report, May 1959.** General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 21 Jun 1959. 64p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93001226. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Pu production from separation plants during May was 116% commitments. UO_3 production and shipments met schedules. Button output and shape production was 97 and 121% of schedule/forecast. Recuplex (product recovery) operated at record rates. Processing at Purex was carried out with the HS column bypassed. Palm processing resulted in excellent product quality but with low yield. A sample of fission products was prepared for Curtiss-Wright. Piping modifications were made to the Purex Pu ion exchange units. One Redox feed batch was prepared with dichromate oxidation; the U and Pu streams increased (Ru) as anticipated. Containers and casks were designed for fission product recovery. Design of installation for subassembly of Pit 65 weapon components was begun.

208 (HW–60915-Del.) **Chemical Processing Department monthly report, June 1959.** MacCready, W.K. General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 22 Jul 1959. 66p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93001227. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Production of Pu from separations plants and output of unfabricated Pu exceeded commitments. Purex plant set a new record high for U processed. Production and shipments of UO_3 met schedules. Purex solvent extraction battery performed below normal, probably because of poor solvent quality. NaOH addition to Redox coating removal waste is being reduced. A 3fold improvement in Recuplex product Al impurity was achieved by means of a

specific gravity difference > 0.15 between dilute aqueous feed and extractant. Sintered, high-silica crucibles are being tested in RMA production line in Finished Products Operation. Scope design of a fission product shipping cask was completed; powder temperature should be below 440 F for 1 MCi cerium-144 + impurities. Feasibility of using one outside Purex canyon entrance (stairwell opening) for relief damper opening was tested and found to be insufficient. A drawing of the 6-inch continuous centrifuge being evaluated as a vacuum drum filter on RMA button line was reviewed. Casks were designed for the NPR project. (DLC)

209 (HW–63313-Del.) **Chemical Processing Department monthly report, December 1959.** MacCready, W.K. General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 21 Jan 1960. 61p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93001228. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Production of Pu nitrate from separations plants exceeded commitments. Two Np recovery runs were made, a routine one at Purex and a demonstration run at Redox. Total Np recovered in CY 1959 was 5.7 kg. The UO_3 plant production and shipments also met commitments. Production of unfabricated Pu metal continued. Process studies are being conducted in Purex to resolve the problems in the Np recovery effort. A new solvent (hexone) condensate decanter was operated in Redox. Reprocessing of nonproduction reactor fuels is being reviewed. (DLC)

210 (HW–65165-Del.) **Chemical Processing Department monthly report for May 1960.** General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 20 Jun 1960. 50p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93001783. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Production of Pu nitrate from separations plants during May was below forecast. A Np recovery campaign in Purex yielded 1.5 kg. Production and shipments of UO_3 met schedules. Unfabricated Pu metal production was below forecast, but all shipments were on schedule. Decontamination efficiency was low in Purex solvent extraction around the time of the Np recovery. The damaged Redox B-2 dissolver is being restored; processing of enriched metal in A and C dissolvers was continued. A spectrograph for inclusions in Pu metal was installed. 4 kg Pu oxide was produced in a continuous direct calciner. Scope design on Purex Np recovery and purification facilities was completed. Other design and contracts are discussed.

211 (HW–66271-Del.) **Chemical Processing Department monthly report for July 1960.** General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 22 Aug 1960. 54p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93001784. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Production of Pu nitrate from separations plant during this month was below forecast. UO_3 production, shipments met schedules; so did unfabricated Pu shipments. Purex plant was stopped to replace the final waste concentrator (F-11) (leak). Two Pu-U partition failures were attributed to foreign organic material in the nitric acid; the Pu product was kept within specifications by adding NaF and ANN to ion exchange feed stream. A Np recovery run was started in Redox, and dissolution was started of 12 special 2-ton test batches of normal U fuel elements, irradiated to provide information on Pu formation rates. The damaged B-2 E-metal dissolver was replaced with a conventional dissolver. Test of a new sieve plate cartridge in Recuplex H-1 extraction column was stopped. A new semi-continuous product concentrator-stripper was made to replace Recuplex batch concentrator. Conversion of Purex prototype anion exchange to a manufacturing unit is nearly complete. Design was completed on the new Redox E-metal dissolver. Process feed was introduced into RMC button line and 3 buttons made. Project proposal for NPF reprocessing was revised.

212 (HW–69443) **Chemical Processing Department monthly report, April 1961.** Reinker, P.H. General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 22 May 1961. 55p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93001229. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Pu nitrate production was above revised forecast. 141 kCi Sr-90 was isolated in Purex and stored for decay; to date, 1190 kCi has been recovered from Purex wastes. Casks of Cs-137 and Sr-90 were turned over to AEC for ORNL. Production of UO_3, Pu metal buttons, and weapon component fabrication exceeded forecasts. Purex processing continued until April 14. The Purex neptunium campaign had low yield because of loss to waste system. The cartridge in the Purex co-decontamination column scrub section was replaced with a new design. After the Redox organic distillation pot was replaced, γ activity in Redox recovered hexone increased 300 $\times$; product quality returned to normal after the faulty steam traps were replaced. Fabricated parts underwent dimensional changes after machining and gaging; part dimensions have been altered to compensate. Design for the proposed caisson-lateral leak detection system was revised to contain 3 horizontal laterals beneath each tank and 7 vertical wells around each tank. A ratio exists between the Cs-137 in the coating waste solution and the total U in liquid and precipitate phases. (DLC)

0509 Transport, Handling, and Storage

Refer also to citation(s) 300, 1204, 1215, 1222, 1223, 1225, 1228

213 (CEA-CONF–10983) **The new transport regulations for radioactive and dangerous materials. Presentation of the new regulations for the transport of radioactive materials.** Grenier, M. CEA Centre d'Etudes de Fontenay-aux-Roses, 92 (France). Inst. de Protection et de Surete Nucleaire. 1992. 8p. (In French). (CONF-9203186–: Colloquium of the French Society of Radioprotection, Paris (France), 27 Mar 1992). Order Number DE93721045. Source: OSTI; NTIS (US Sales Only); INIS.

The paper presents the modifications of French transport regulations to take into account the IAEA recommendations and the European conventions for rail and road transport.

214 (CONF-920905–7) **An assessment of the potential impacts on irradiated nuclear fuel transportation operations of applying ICRP Publication 60 recommendations to transport regulations.** Pope, R.B. (Oak Ridge National Lab., TN (United States)); Ratledge, J.E.; Hill, C.V.; Loud, G.C. Oak Ridge National Lab., TN (United States). [1992]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 10. international symposium on the packaging and transportation of radioactive materials: PATRAM '92; Yokohama (Japan); 13-18 Sep 1992. Order Number DE92040884. Source: OSTI; NTIS; INIS; GPO Dep.

The International Atomic Energy Agency (LAEA) provides the worldwide basis for regulating the transportation of radioactive materials, the current form of which was issued in 1985 and has since been amended (LKEA 1990). This document [denoted here as "Safety Series No. 6"] serves as regulations for activities controlled or funded by the IAEA and as a model for domestic regulations. This paper focuses on the requirements to provide individual dose limitations. This need to implement limitations on individual dose commitments resulted in the requirements in paragraph 204 of Safety Series No. 6.

215 (CONF-920905–22) **An evaluation of Department of Transportation specification packages.** Ratledge, J.E.; Rawl, R.R. Oak Ridge National Lab., TN (United States). [1992]. 12p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC05-84OR21400. From 10. international symposium on the packaging and transportation of radioactive materials: PATRAM '92; Yokohama (Japan); 13-18 Sep 1992. Order Number DE92041302. Source: OSTI; NTIS; INIS; GPO Dep.

Specification packages are broad families of package designs developed and authorized by the US Department of Transportation (DOT) and the Nuclear Regulatory Commission (NRC) for transport of certain Type B and fissile radioactive materials, with each specification containing a number of designs of various sizes. The specification package designs have remained essentially unchanged in a changing regulatory environment. Changes to

package designs or authorized contents under the DOT system can be accomplished by rule making action, but there has been little updating of the designs over the years. Many of the individual package designs are no longer supported by reasonably current safety analyses. Since the publication of these specifications, there have been changes in regulatory requirements and improvements in methods of testing and analysis. Additionally, contemplated revisions to the DOT and NRC regulations to bring design requirements into accord with IAEA Safety Series No. 6, 1985 Edition would eliminate fissile classes and require resistance to a crush test for small Type B packages meeting certain criteria. The NRC has requested that the Oak Ridge National Laboratory (ORNL) staff review the safety documentation of the specification packages to determine the possible need for further testing and analysis, modifications to the designs, and, perhaps, elimination of any designs for which there is insufficient demonstration of compliance with current and proposed requirements. This paper will present a summary of the technical data and information concerning the use of the packages that has been received to date.

0510 Economic, Industrial, and Business Aspects

Refer also to citation(s) 799, 2451

0520 Waste Management

Refer also to citation(s) 159, 160, 161, 162, 163, 164, 175, 187, 188, 286, 287, 288, 289, 290, 291, 292, 293, 300, 301, 637, 638, 641, 651, 666, 1022, 1023, 1024, 1025, 1079, 1080, 1081, 1082, 1083, 1121, 1176, 1177, 1178, 1188, 1196, 1453, 1544, 1545, 1546, 1563, 1571, 1592, 1593, 1594, 1595, 1596, 1597, 1598, 1599, 1600, 1601, 1602, 1603, 1604, 1605, 1606, 1607, 1608, 1609, 1610, 1611, 1612, 1613, 1614, 1615, 1616, 1617, 1618, 1619, 1620, 1621, 1622, 1623, 1659, 1660, 1661, 1675, 2482, 2493

216 (AECL–6186(rev.5)) **Radioactive waste management in Canada: AECL Research publications and other literature, 1953-1990.** Atomic Energy of Canada Ltd., Chalk River, ON (Canada). Chalk River Nuclear Labs. Nov 1990. 217p. Order Number DE93603990. Source: OSTI; NTIS (US Sales Only); INIS.

This bibliography is a review of the Canadian literature on radioactive waste management from 1953 to the present. It incorporates the references from the previous AECL–6186 revisions, and adds the current data and some of the references that had been omitted. Publications from outside organizations of concern to the Canadian Nuclear Fuel Waste Program are included in addition to AECL Research reports and papers. This report is intended as an aid in the preparation of the Concept Assessment Document and is complementary to AECL Research's internal document-ready references on the MASS-11 word processing systems.

217 (AECL–9566-3(Vol.1,2)) **Underground Research Laboratory room 209 Instrument array. Vol. 1,2: Measured response to excavation.** Lang, P.A.; Kuzyk, G.W.; Babulic, P.J.; Bilinsky, D.M.; Everitt, R.A.; Spinney, M.H.; Kozak, E.T.; Davison, C.C. Atomic Energy of Canada Ltd., Pinawa, MB (Canada). Whiteshell Nuclear Research Establishment. Jun 1991. 280p. Order Number DE93605933. Source: OSTI; NTIS (US Sales Only); INIS.

An in situ excavation response test was conducted at the 240 Level of the Underground Research Laboratory (URL). The test was carried out in conjunction with the drill-and-blast excavation of a near-circular tunnel (Room 209), about 3.5 m in diameter. The tunnel was excavated through a tunnel axis. Three modelling groups made predictions of the response of the rock mass and hydraulic behaviour of the water-bearing fracture to excavation. The tunnel was excavated in two stages, a pilot tunnel followed by a slash, providing two complete sets of response measurements. Careful excavation was carried out to ensure the excavation shape after each blast round agreed closely with the planned shape incorporated in the numerical models. Instrumentation installed before the tunnel was extended monitored the complete strain tensor at eight locations around the tunnel, radial displacements and piezometric pressures at nine locations in the fracture. As well, tunnel convergence, water flows from the fracture, and hydraulic conductivity of the fracture at nine locations, were measured after each excavation step. The final tunnel profiles were accurately surveyed, and the geology was mapped in detail. The results are presented in this report for comparison with the modellers' predictions (reported in AECL–9566-2). Some preliminary conclusions and recommendations regarding the field testing are presented.

218 (AECL–10279) **Assessment of the long-term risks of inadvertent human intrusion into a proposed Canadian nuclear fuel waste disposal vault in deep plutonic rock.** Wuschke, D.M. Atomic Energy of Canada Ltd., Pinawa, MB (Canada). Whiteshell Nuclear Research Establishment; Ontario Hydro, Toronto, ON (Canada). May 1992. 83p. (COG–92-151.). Order Number DE93604001. Source: OSTI; NTIS (US Sales Only); INIS.

This report describes the methodology developed to assess the long-term risk from inadvertent human intrusion into such a facility, and the results of its application to the proposed facility. Four intrusion scenarios were analysed, all initiated by a drilling operation. These scenarios are exposure of a member of the drilling crew, of a technologist conducting a core examination, of a construction worker and of a resident. The consequence of each scenario was estimated using standard computer codes for environmental pathways analysis and radiation dosimetry. For comparison with the risk criterion, an estimate of the probability of each scenario is also required. An event-tree methodology was used to estimate these probabilities. The estimated risks from these intrusion scenarios are several orders of magnitude below the established risk criterion. The event-tree methodology has the advantages of explicitly displaying the assumptions made, of permitting easy testing of the sensitivity of the risk estimates to assumptions, and of combining technical and sociological information.

219 (BNL–47775) **Computer models used to support cleanup decision-making at hazardous and radioactive waste sites.** Moskowitz, P.D.; Pardi, R.; DePhillips, M.P.; Meinhold, A.F. Brookhaven National Lab., Upton, NY (United States). Jul 1992. 102p. Sponsored by USDOE, Washington, DC (United States); Environmental Protection Agency, Washington, DC (United States); Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC02-76CH00016. Order Number DE92040575. Source: OSTI; NTIS; INIS; GPO Dep.

Massive efforts are underway to cleanup hazardous and radioactive waste sites located throughout the US To help determine cleanup priorities, computer models are being used to characterize the source, transport, fate and effects of hazardous chemicals and radioactive materials found at these sites. Although, the US Environmental Protection Agency (EPA), the US Department of Energy (DOE), and the US Nuclear Regulatory Commission (NRC) have provided preliminary guidance to promote the use of computer models for remediation purposes, no Agency has produced directed guidance on models that must be used in these efforts. To identify what models are actually being used to support decision-making at hazardous and radioactive waste sites, a project jointly funded by EPA, DOE and NRC was initiated. The purpose of this project was to: (1) Identify models being used for hazardous and radioactive waste site assessment purposes; and (2) describe and classify these models. This report presents the results of this study.

220 (CEA-CONF–10808) **French High-level waste management research and development program.** Moncouyoux, J.P.; Sombret, C. CEA Centre d'Etudes de la Vallee du Rhone, 30 - Marcoule (France). Dept. des Procedes de Retraitement. 1992. 3p. (CONF-920430–: 3. international high level radioactive waste management (IHLRWM) conference, Las Vegas, NV (United States), 12-16 Apr 1992). Order Number DE93721039. Source: OSTI; NTIS (US Sales Only); INIS.

The French programme includes vitrification of fission products from reprocessing and cold-crucible melting of fuel cladding hulls.

221 (CEA-CONF–10981) **HLW immobilization in glass: Industrial operation and product quality.** Jacquet-Francillon, N. (CEA Centre d'Etudes de la Vallee du Rhone, 30 - Marcoule (France). Dept. des Procedes de Retraitement); Leroy, P.; Runge, S. CEA Centre d'Etudes de la Vallee du Rhone, 30 - Marcoule (France). Dept. des Procedes de Retraitement. 1992. 4p. (CONF-920430–: 3. international high level radioactive waste management

(IHLRWM) conference, Las Vegas, NV (United States), 12-16 Apr 1992). Order Number DE93721043. Source: OSTI; NTIS (US Sales Only); INIS.

This extended summary discusses the immobilization of high level wastes from the viewpoint of the quality of the final product, i.e. the HLW glass. The R and D studies comprise 3 steps: glass formulation, glass characterization and long term behaviour studies.

222 (CEA-CONF–11003) **New organic chelating agents for complexation of cations. Application to nuclear waste treatment.** Cuillerdier, C.; Musikas, C.; Nigond, L. CEA Centre d'Etudes de la Vallee du Rhone, 30 - Marcoule (France). Dept. des Procedes de Retraitement. 1992. 3p. (CONF-9209235–: ISECOS 92: International Organic Substances Solvent Extraction Conference, Voronezh (Russian Federation), 22-25 Sep 1992). Order Number DE93721112. Source: OSTI; NTIS (US Sales Only); INIS.

Pentaalkylpropanediamides are powerful extractants for the treatment of both nitric and chloride wastes. They are easily synthesized and purified. Containing no phosphorus atom they can be completely incinerated, creating no secondary wastes. Extraction is optimized by a proper choice of alkyl substituents allowing high extraction efficiency for Am^{3+}, use of aliphatic diluents without third phase formation in contact of concentrated nitric acid, low aqueous solubility, increased iron separation and stability toward hydrolysis and radiolysis.

223 (CEA-CONF–11027) **Management of slightly tritiated wastes and associated tests at the Study Center of Bruyeres le Chatel.** Paillard, P.; Clerc, H. CEA Centre d'Etudes de Bruyeres-le-Chatel, 91 (France). 1991. 12p. (In French). (CONF-910920–: 4. topical meeting on tritium technology in fission, fusion, and isotopic applications, Albuquerque, NM (United States), 29 Sep - 4 oct 1991). Order Number DE93721147. Source: OSTI; NTIS (US Sales Only); INIS.

Daily degassing rate of drums containing wastes with a low tritium content is a required parameter for removal towards a storage site. Methodology and techniques of increasing sensitivity used for this rate measurement are presented. For 200-liter drums, the degassing range is comprised between 0.1 MBq and 1.85 GBq per day. Equipment has been operating for several years allowing the dispatching of 443 drums and also the testing of on-site storage before disposal.

224 (CONF-921029–5) **Implementation of environmental compliance for operating radioactive liquid waste systems at the Oak Ridge National Laboratory.** Hooyman, J.H.; Robinson, S.M. Oak Ridge National Lab., TN (United States). 19 Oct 1992. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Annual Department of Energy model conference on waste management and environmental restoration; Oak Ridge, TN (United States); 19-22 Oct 1992. Order Number DE93000433. Source: OSTI; NTIS; INIS; GPO Dep.

This paper addresses methods being implemented at the Oak Ridge National Laboratory (ORNL) to continue operating while achieving compliance with new standards for liquid low level waste (LLLW) underground storage tank systems. The Superfund Amendment and Reauthorization Act (SARA) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) required that the Department of Energy (DOE) execute a Federal Facility Agreement (FFA) with the Environmental Protection Agency (EPA) within 6 months of listing of the ORNL on the National Priorities List. An FFA for ORNL became effective January 1, 1992 among the EPA, DOE, and the Tennessee Department of Environment and Conservation (TDEC). The agreement ensures that environmental impacts resulting from operations at the Oak Ridge Reservation are investigated and remediated to protect the public health, welfare, and environment.

225 (DOE/ER–1070-D1) **Field sampling and analysis plan for the remedial investigation of Waste Area Grouping 2 at Oak Ridge National Laboratory, Oak Ridge, Tennessee: Environmental Restoration Program.** Boston, H.L.; Ashwood, T.L.; Borders, D.M.; Chidambariah, V.; Downing, D.J.; Fontaine, T.A.; Ketelle, R.H.; Lee, S.Y.; Miller, D.E.; Moore, G.K.; Suter, G.W.; Tardiff, M.F.; Watts, J.A.; Wickliff, D.S. Oak Ridge National Lab., TN (United States). Feb 1992. 235p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. (ORNL/ER–58-D1). Order Number DE92010909. Source: OSTI; NTIS; INIS; GPO Dep.

Environmental Sciences Division Publication No. 3780.

This field sampling and analysis (S & A) plan has been developed as part of the Department of Energy's (DOE's) remedial investigation (RI) of Waste Area Grouping (WAG) 2 at Oak Ridge National Laboratory (ORNL) located in Oak Ridge, Tennessee. The S & A plan has been written in support of the remedial investigation (RI) plan for WAG 2 (ORNL 1990). WAG 2 consists of White Oak Creek (WOC) and its tributaries downstream of the ORNL main plant area, White Oak Lake (WOL), White Oak Creek embayment (WOCE) on the Clinch River, and the associated floodplain and subsurface environment (Fig. 1.1). The WOC system is the surface drainage for the major ORNL WAGs and has been exposed to a diversity of contaminants from operations and waste disposal activities in the WOC watershed. WAG 2 acts as a conduit through which hydrologic fluxes carry contaminants from upgradient areas to the Clinch River. Water, sediment, soil, and biota in WAG 2 are contaminated and continue to receive contaminants from upgradient WAGs. This document describes the following: an overview of the RI plan, background information for the WAG 2 system, and objectives of the S & A plan; the scope and implementation of the first 2 years of effort of the S & A plan and includes recent information about contaminants of concern, organization of S & A activities, interactions with other programs, and quality assurance specific to the S & A activities; provides details of the field sampling plans for sediment, surface water, groundwater, and biota, respectively; and describes the sample tracking and records management plan.

226 (DOE-HMIP-RR–92.031) **Review of the interactions between bentonite and cement.** Duerden, S.L. Building Research Establishment, Watford (United Kingdom). 1992. 26p. Sponsored by Department of the Environment, London (United Kingdom). Her Majesty's Inspectorate of Pollution. Contract ENP/006/02;M1212. (BRE-CR–5/92.). Order Number DE93605934. Source: OSTI; NTIS (US Sales Only); INIS.

Properties of bentonite may be significantly affected by reaction with cement. This report reviews the literature to identify the reactions that may occur and considers their effects on the performance of bentonite in these applications. The dominant reactions expected under alkaline conditions prevalent in an underground repository where cement is used extensively are zeolitization, beidellitization, and ion exchange. Zeolitisation will occur at high temperatures (200°C) or after long periods (500-1000 years) when the pH is high (pH>9). Beidellitization may occur at high pH (pH>9). The silica may reprecipitate in situ due to low hydraulic conductivity or in regions of low pH or temperature. This may result in reduced porosity/permeability and plasticity. Ion exchange reactions are virtually instantaneous. The rate of the reaction depends on the concentration and rate of access of ground water. Substitution of Ca^{2+} ions from cement for Na^{+} ions in sodium-bentonites will result in reduced swelling pressure and plasticity, and increased hydraulic conductivity of the bentonite. The effect of Na-bentonite on the properties of cement is the formation of an Al-substituted 11A tobermorite, which results in improved Cs^{+} sorption. In cements reacted with Calcium-bentonite the main product was found to be a hydroxyapatite layer on the cement surface. (author).

227 (DOE/NV/10384–13) **Studies of infiltration and lead-soil interactions at the Radioactive Waste Management Site in Area 5 of the Nevada Test Site.** Case, C.M.; Davis, J.O.; Heidker, J.C.; Whitbeck, M.R. USDOE Nevada Operations Office, Las Vegas, NV (United States). Jul 1992. 32p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC08-85NV10384. Order Number DE93002867. Source: OSTI; NTIS; INIS; GPO Dep.

Publication No. 45054.

Several studies were conducted to investigate the possibility of buried lead being transported by water in the unsaturated zone at the Area 5 Radioactive Waste Management Site (RWMS) on the Nevada Test Site. All involved soil from a 37-m soil core collected at the RWMS. The core consisted primarily of sand and small pebbles, with occasional layers of loose rocks. Few buried soil horizons were observed, and the core showed no evidence of a

carbonate layer that would act as a barrier to infiltration. Samples chosen from various depths in the soil core were analyzed chemically. Calcium and sulfate occurred in a prominent layer about 5 m below the surface. The concentration of soluble carbonate increased gradually with depth, while chloride concentrations decreased. Lead concentrations ranged from 1 to 2 mg/kg. Additional data from the soil core were combined with results of earlier field infiltration studies at two sites near the RWMS to estimate flow velocities for water in the unsaturated zone. Under normal (dry) conditions, the degree of saturation is so small that gravity drainage does not occur; water moves by vapor transport and capillary action. Significant water movement occurs only if the soil is at or near saturation. The results suggest that even continuously ponded water at the RWMS would take several months to infiltrate to the water table. Seven samples from the soil core were tested for their ability to adsorb lead. All took up lead with about the same intensity and capacity. Adsorption of lead by insoluble carbonate minerals and precipitation of lead by soluble carbonate in the soil at the RWMS should provide a barrier to lead migration. Finally, measurements were made of the corrosion rates of lead and steel in contact with soil samples from the core. Corrosion rates generally increased with increasing soil saturation at all depths. Under ambient soil conditions at the RWMS, corrosion rates would be low.

228 (DOE/OR–1054-D1) **Phase 2 Sampling Plan for Chestnut Ridge Operable Unit 2 (Filled Coal Ash Pond/Upper McCoy Branch) at the Oak Ridge Y-12 Plant, Oak Ridge, Tennessee: Environmental Restoration Program.** Oak Ridge Y-12 Plant, TN (United States); CDM Federal Programs Corp., Oak Ridge, TN (United States). Aug 1992. 272p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OS21400. (Y/ER–42-D1). Order Number DE92041271. Source: OSTI; NTIS; INIS; GPO Dep.

CDM Federal Programs Corporation (CDM Federal) was contracted by Martin Marietta Energy Systems, Inc. to prepare a Phase H Sampling Plan to describe field investigation work necessary to address regulatory agency review comments on the Remedial Investigation of Filled Coal Ash Pond (FCAP)/Upper McCoy Branch, Chestnut Ridge Operable Unit 2 at the Y-12 Plant, conducted by CH2M Hill in 1990. The scope and approach of the field investigation described in this plan specifically focus on deficiencies noted by the regulators in discussions at the comment resolution meeting of May 8, 1992, in Oak Ridge, Tennessee. This Phase II Sampling Plan includes a field sampling plan, a field and laboratory quality assurance project plan, a health and safety plan, a waste management plan, and appendixes providing an update to applicable or relevant and appropriate requirements for this site and field and laboratory testing methods and procedures. To address deficiencies noted by the regulators, the following activities will be conducted: Background surface soil and surface water/sediment samples will be collected based on statistical considerations for comparison to site data. Existing and new data to be collected will be used to support a human health risk assessment that includes the future homesteader scenario. Biological surveys, samples, and measurements will be collected/conducted to augment existing data and support an ecological risk assessment. Another round of groundwater sampling will be conducted, including on-site wells and the wells on Chestnut Ridge downgradient of the Security Pits. Borings will be completed in the FCAP to collect samples from below the surface depth to describe the chemical characteristics and volume of the ash. The volume of ash associated with sluice channel on Chestnut Ridge will be determined. Soil samples will be corrected below the coal ash in the FCAP and adjacent to sluice channel to evaluate soil contamination and migration of contaminants.

229 (DOE/RL–90-48) **Hanford Site single-shell tank roadmap.** USDOE Richland Field Office, WA (United States). Apr 1991. 251p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93001475. Source: OSTI; NTIS; INIS; GPO Dep.

The Hanford Site Single-Shell Tank Roadmap covers the near-term waste management activities to ensure safe interim storage of 140 million liters of waste. It also addresses the environmental restoration activities to close the 6 single-shell tank operable units, which include 149 single-shell tanks. These tanks were constructed starting in the 1940's. Sixty-six tanks have leaked or are assumed to be leaking. This Roadmap has highlighted the need for integrated planning and resource allocation. The June 1990 Five-Year Plan did not address the tank safety concerns that evolved since its publication. Potential impacts to Tri-Party Agreement milestones for characterization, stabilization and isolation, technology development/demonstration, and closure will be examined in greater detail to strengthen the technical decision basis and to minimize consequences. The Roadmap indicates the advantage of accelerating characterization programs, technology evaluations, and supplemental environmental impact statement preparation. Working with regulators and expanded public outreach programs are essential to successful completion of this activity.

230 (DOE/RW–0361-SR) **Science, society, and America's nuclear waste: Unit 1, Nuclear waste.** USDOE Office of Civilian Radioactive Waste Management, Washington, DC (United States). [1992]. 29p. Sponsored by USDOE, Washington, DC (United States). Source: OSTI (Free of Charge); INIS.

This publication presents in layman's terms a review of energy and electricity, then discusses in depth nuclear waste, what it is and where it is.

231 (DOE/RW–0369) **Physical system requirements - Accept waste.** USDOE Office of Civilian Radioactive Waste Management, Washington, DC (United States). Aug 1992. 93p. Sponsored by USDOE, Washington, DC (United States). Order Number DE92041118. Source: OSTI; NTIS; INIS; GPO Dep.

The Nuclear Waste Policy Act (NWPA) assigned to the Department of Energy (DOE) the responsibility for managing the disposal of spent nuclear fuel and high-level radioactive waste and established the Office of Civilian Radioactive Waste Management (OCRWM) for that purpose. The Secretary of Energy, in his November 1989 report to Congress (DOE/RW-0247), announced new initiatives for the conduct of the Civilian Radioactive Waste Management (CRWM) program. One of these initiatives was to establish improved management structure and procedures. In response, OCRWM performed a management study and the OCRWM Director subsequently issued the Management Systems improvement Strategy (MSIS) on August 10, 1990, calling for a rigorous implementation of systems engineering principles with a special emphasis on functional analysis. The functional analysis approach establishes a framework for integrating the program management efforts with the technical requirements analysis into a single, unified, and consistent program. This approach recognizes that just as the facilities and equipment comprising the physical waste management system must perform certain functions, so must certain programmatic and management functions be performed within the program in order to successfully bring the physical system into being. Thus, a comprehensive functional analysis effort has been undertaken which is intended to: Identify the functions that must be performed to fulfill the waste disposal mission; Identify the corresponding requirements imposed on each of the functions; and Identify the conceptual architecture that will be used to satisfy the requirements. The principal purpose of this requirements document is to present the results that were obtained from the conduct of a functional analysis effort for the Accept Waste mission.

232 (DOE/RW–0371P) **International nuclear fuel cycle fact book.** USDOE Office of Civilian Radioactive Waste Management, Washington, DC (United States). Sep 1992. 326p. Sponsored by USDOE, Washington, DC (United States). Source: OSTI (Free of Charge); INIS.

The International Nuclear Fuel Cycle Fact Book has been compiled in an effort to provide current data concerning fuel cycle and waste management facilities, R&D programs and key personnel on 23 countries, including the US, four multi-national agencies, and 21 nuclear societies. The Fact Book is organized as follows: National summaries-a section for each country which summarizes nuclear policy, describes organizational relationships, and provides addresses and names of key personnel and information on facilities. International agencies-a section for each of the international agencies which has significant fuel cycle involvement and a listing of nuclear societies. Glossary-a list of abbreviations/acronyms of organizations, facilities, technical and other terms. The national summaries, in addition to the data described above, feature a

small map for each country as well as some general information. The latter presented from the perspective of the Fact Book user in the United States.

233 (EUR–13798) **Dross and ultrafine particulate formation in underwater plasma-arc cutting.** Waldie, B. (Heriot-Watt Univ); Harris, W.K. Commission of the European Communities, Luxembourg (Luxembourg). 1991. 150p. Contract No F11D-0008. Source: OSTI; NTIS (US Sales Only); INIS.

Production rates and detailed chemical and physical characteristics of solid emissions from underwater plasma-arc cutting of non-active 304 grade stainless steel have been studied. Steel thicknesses to 40 mm have been cut in water depths of up to 10 metres. An hyperbaric vessel and a deep water test column and associated experimental equipment and techniques were developed for these studies. Concentrations and compositions of effluent by-product gases were also investigated. Part of the work done has been jointly with CEA Saclay and other institutions. Quantitative data, and possible mechanisms involved in the following aspects of the project were achieved: distribution, particle size and composition of solid emissions; composition and flowrates of effluent gases; effect of depth and other cutting conditions on solid and gaseous emissions; filtration resistance characteristics of water suspended particles; repeatability of cut quality and yields of emissions under standard cutting conditions.

234 (EUR–13985) **Pilot tests on radioactive waste disposal in underground facilities.** Haijtink, B. Commission of the European Communities, Luxembourg (Luxembourg). 1992. 292p. (CONF-9106403–: Workshop on Pilot tests on radioactive waste disposal in underground facilities, Braunschweig (Germany), 19-20 Jun 1991). Source: OSTI; NTIS (US Sales Only); INIS.

The report describes the pilot test carried out in the underground facilities in the Asse salt mine (Germany) and in the Boom clay beneath the nuclear site at Mol (Belgium). These tests include test disposal of simulated vitrified high-level waste (HAW project) and of intermediate level waste and spent HTR fuel elements in the Asse salt mine, as well as an active handling experiment with neutron sources, this last test with a view to direct disposal of spent fuel. Moreover, an in situ test on the performance of a long-term sealing system for galleries in rock salt is described. Regarding the tests in the Boom clay, a combined heating and radiation test, geomechanical and thermo-hydro mechanical tests are dealt with. Moreover, the design of a demonstration test for disposal of high-level waste in clay is presented. Finally the situation concerning site selection and characterization in France and the United Kingdom are described.

235 (EUR–14093) **Fissures and boreholes plugging in fractured geologic deposits (granites).** Boisson, J.Y. (CEA Centre d'Etudes de Fontenay-aux-Roses, 92 (France). Inst. de Protection et de Surete Nucleaire). Commission of the European Communities, Luxembourg (Luxembourg). 1992. 275p. (In French). Contract FI1W/0058F. Source: OSTI; NTIS (US Sales Only); INIS.

This report gives the results of bench-scale experiments and field tests, destined to describe the bentonite behavior in fractured scale models and in boreholes, and to allow to study the rock weathering phenomenons under specific conditions. Dry and compact bentonite, used for exploratory drilling plugging, in crystalline rock deposits and in contact with groundwater, show hydration, swelling and mobility properties with penetration in conducting fractures. The purpose of this work is to define the procedure of clay weathering after the swelling phase, under groundwater circulation effect, to estimate plugs longevity. This study is prepared for the European Atomic Energy Community cost-sharing research program on radioactive waste management and disposal. 63 refs., 100 figs., 30 tabs., 17 plates.

236 (EUR–14097) **Development of test methods for quality control of LLW and MLW in cement or polymers (Parts 1 and 2). Task 3. Characterization of radioactive waste forms. A series of final reports (1985-1989) no. 39.** Angelis, G. de (ENEA, Casaccia (Italy). Centro Ricerche Energia); Marchetti, A.; Balzamo, S. Commission of the European Communities, Luxembourg (Luxembourg). 1992. 126p. Contract FI1W-0101 I. Source: OSTI; NTIS (US Sales Only); INIS.

This report is divided into two parts. In the first part, the qualification of samples arising from the cementation of low (LLW) and intermediate level (MLW) radioactive wastes is studied. In particular, bead ion exchange resins, filter sludges, BWR evaporator concentrates and decontamination solutions have been taken into account. The properties of the final waste forms have been compared with the ones of laboratory scale samples. The qualification of the solidified wastes was performed according to the requirements of the Italian Regulatory Body. Particular attention is devoted to mechanical and thermal properties, biodegradability and behaviour versus water. In the second part, the influence of different parameters on the leaching of Cesium from cemented BWR evaporator concentrates (sulfates) is tested. In particular the influence of the variation of temperature, initial concentration of the tracer, renewal and chemical composition of the leachant, size of the sample, has been tested. 20 refs., 68 figs., 21 tabs.

237 (EUR–14154) **Geomechanical behaviour of boom clay under ambient and elevated temperature conditions.** Neerdael, B. (Centre d'Etude de l'Energie Nucleaire, Mol (Belgium)); Beaufays, R.; Buyens, M.; Bruyn, D. de; Voet, M. Commission of the European Communities, Luxembourg (Luxembourg). 1992. 108p. Contract FI1W-0055. Source: OSTI; NTIS (US Sales Only); INIS.

This research is focused upon in-situ investigations related to the (thermo-) mechanical behaviour of clay. Three main items are covered in this research area: Stress measurements around the underground research facility for radioactive waste disposal using hydraulical stress monitoring stations; detection of micro-fractures in the clay host, mainly using geophysical seismic techniques; long term mechanical behaviour of clay (this last item, studied by ANDRA at Mol, is not described in this paper). The stress monitoring stations appear to be more reliable in getting relative pressure variations with time rather than absolute values of stress, even after studying and improving the characteristics of the surrounding grout. The seismic techniques used to appear to be sensitive and accurate enough for detecting induced fracturation in the clay host, even for the low temperature. This is also in agreement with bench-scale experiments on clay samples intended to quantify the influence of both temperature and consolidation on the velocity. 10 refs., 80 figs., 3 tabs.

238 (EUR–14156) **Modelling of radionuclide migration and heat transport from an High-Level-Radioactive-Waste-repository (HLW) in Boom clay.** Put, M. (Centre d'Etude de l'Energie Nucleaire, Mol (Belgium)); Henrion, P. Commission of the European Communities, Luxembourg (Luxembourg). 1992. 261p. Contract FI1W-0055. Source: OSTI; NTIS (US Sales Only); INIS.

For the modelling of the migration of radionuclides in the Boom clay formation, the analytical code MICOF has been updated with a 3-dimensional analytical solution for discrete sources. the MICOF program is used for the calculation of the release of α and β emitters from the HIGH LEVEL RADIOACTIVE WASTES (HLW). A coherent conceptual model is developed which describes all the major physico-chemical phenomena influencing the migration of radionuclides in the Boom clay. The concept of the diffusion accessible porosity is introduced and included in the MICOF code. Different types of migration experiments are described with their advantages and disadvantages. The thermal impact of the HLW disposal in the stratified Boom clay formation has been evaluated by a finite element simulation of the coupled heat and mass transport equation. The results of the simulations show that under certain conditions thermal convection cells may form, but the convective heat transfer in the clay formation is negligible. 6 refs., 19 figs., 2 tabs., 5 appendices.

239 (EUR–14363, pp. 167-188) **Melting of radioactive scrap. A.- Experience gained by SGR and Siemens with the melting of radioactive scrap. B.- First results obtained with the melting of alpha-contaminated steel scrap.** Sappok, M.; Graebener, K.H. Commission of the European Communities, Luxembourg (Luxembourg). 1992. (CONF-9109441–: 2. Seminar on practical decommissioning experience with nuclear installations in the European Community, Sellafield (United Kingdom), 25-26 Sep

1991). In *Practical decommissioning experience with nuclear installations in the European Community.* 207p. Order Number DE93721081. Source: OSTI; NTIS (US Sales Only); INIS.

The part A deals with the process of melting radioactive scrap in Germany within the framework of research contracts sponsored by European Community from 1984 to 1989. Up to now more than 3500 tons of low-level scrap (< 200 Bq/g) have been melted and recycled. The scrap, has about 95% of Co and Cs 137 activity. In the average the ratio between Co und Cs was 60: 40. Cs quantitatively was found in slag and filter dust, whereas cobalt remained in the ingot. In 1989, a separate and modernized facility was erected. The maximum activity level to be handled is 200 Bq/g. In this new plant 2000 tons have been treated up to now. The part B deals with the results for melting of alpha contaminated steel scrap. Up to now a part of the necessary procurement has been realized for this research program. The delivery of 100 t of material for the melting campaign at SGR has been terminated. The melting approval has been given, the permit for the handling of the radioactive substances for the residual materials due to nuclear fuel concentration has not yet been obtained from the authorities. The test program for the performance of the trials at SGR has been elaborated and must still be coordinated with the authorities. During the first working period in the Siemens laboratories the experimental equipment for the melting of steel scrap was installed and tested. THe main components are the electrical power supply and the inductively heated furnace.

240 (EUR–14363, pp. 189-195) **Conclusions of a study for the large scale melting of radioactive steel scrap arising from the dismantling of nuclear installations.** Cross, M.T. (UKAEA Northern Research Labs. Windscale, Seascale (United Kingdom)). Commission of the European Communities, Luxembourg (Luxembourg). 1992. (CONF-9109441–: 2. Seminar on practical decommissioning experience with nuclear installations in the European Community, Sellafield (United Kingdom), 25-26 Sep 1991). In *Practical decommissioning experience with nuclear installations in the European Community.* 207p. Order Number DE93721081. Source: OSTI; NTIS (US Sales Only); INIS.

This Summary Paper gives an overview of the feasibility assessment carried out by AEA Technology for the evaluation of melting as a waste conditioning method for metallic Low-Level Wastes (LLW). The assessment wa carried out on behalf of BNFL, Nuclear Electric (NE) and the Department of Energy (DEn) in a work programme started in 1987 and completed during 1990. The salient technical findings and economic arguments for the method are presented in this brief appraisal of the study.

241 (EUR–14363, pp. 197-202) **Feasibility testing of the incineration of contaminated graphite in a pilot fluidized bed.** Dubourg, M. (Societe Franco-Americaine de Constructions Atomiques (FRAMATOME), 92 - Courbevoie (France)). Commission of the European Communities, Luxembourg (Luxembourg). 1992. (CONF-9109441–: 2. Seminar on practical decommissioning experience with nuclear installations in the European Community, Sellafield (United Kingdom), 25-26 Sep 1991). In *Practical decommissioning experience with nuclear installations in the European Community.* 207p. Order Number DE93721081. Source: OSTI; NTIS (US Sales Only); INIS.

Level 3 dismantling of G2 et G3 gas-cooled reactors in Marcoule requires the processing of graphite used as neutron moderator. The technique recommended by Framatome involves crushing, milling, and burning the contaminated graphite in an'active' circulating fluidized-bed incinerator installed in the pile chamber of one of the reactors. The use of circulating fluidized-bed techniques for incinerators has been explored by 10 years of research. Several industrial incinerators operating as gas generators have been built to improve the efficiency of low-grade fuels such as slaty or biomass. However the drop in crude oil prices has kept these industrial power generation applications of fluidized-bed incineration from competing effectively on the market. The existence of a pilot facility located at Framatome's development complex in le Creusot and the need to compact combustible low-level waste has renewed interest in this method as a means of processing the waste and reducing the volume of waste packages.

242 (IAEA-TECDOC–652) **Minimization and segregation of radioactive wastes: Technical manual for the management of low and intermediate level wastes generated at small nuclear research centres and by radioisotope users in medicine, research and industry.** International Atomic Energy Agency, Vienna (Austria). Jul 1992. 53p. Order Number DE93603991. Source: OSTI; NTIS (US Sales Only); INIS.

The report will serve as one of a series of technical manuals providing reference material and direct know-how to staff in radioisotope user establishments and research centres in Member States without nuclear power and the associated range of complex waste management operations. Considerations are limited to the minimization and segregation of wastes, these being initial steps on which the efficiency of the whole waste management system depends. The minimization and segregation operations are examined in the context of the restricted quantities and predominantly shorter lived activities of wastes from nuclear research, production and usage of radioisotopes. Liquid and solid wastes only are considered in the report. Gaseous waste minimization and treatment are specialized subjects and are not examined in this document. Gaseous effluent treatment in facilities handling low and intermediate level radioactive materials has been already the subject of a detailed IAEA report. Management of spent sealed sources has specifically been covered in a previous manual. Conditioned sealed sources must be taken into account in segregation arrangements for interim storage and disposal where there are exceptional long lived highly radiotoxic isotopes, particularly radium or americium. These are unlikely ever to be suitable for shallow land burial along with the remaining wastes. 30 refs, 5 figs, 8 tabs.

243 (INFO–0380) **Assessment of computer programs for coupled fluid flow-thermal-mechanical processes in the assessment of deep disposal of radioactive waste.** Acres Consulting Services Ltd., Toronto, ON (Canada); Atomic Energy Control Board, Ottawa, ON (Canada). May 1991. 142p. Project 5.125.1. Order Number DE93604006. Source: OSTI; NTIS (US Sales Only); INIS.

The objective of this project was to review, acquire and install for the AECB one or more computer programs for the analysis of the coupled fluid flow-thermal-mechanical processes that are involved in the deep disposal of high-level nuclear wastes. An assessment of the importance of the various couplings was also to be made. A number of state-of-the-art computer programs were reviewed. None of the programs were capable of modelling all the couplings that are relevant to repository analyses. UDEC, a two-dimensional, discrete-element code which models a rock mass as an assemblage of blocks with fluid flow through the rock joints, was acquired. UDEC also models transient heat flow and thermal stresses. In addition, PLASCON, a finite-element program which simulates two-dimensional thermal elasto-plastic consolidation of porous media, was acquired and installed on Acres VAX 8350 computer. Subsequent to conversion of the programs to a VAX VMS environment and a number of verification runs, analyses were performed at regional, room and canister scales. Although substantial progress was not made in understanding the significance of the couplings, considerable progress was made in understanding the two computer programs and the complexities involved in performing coupled analyses.

244 (INIS-mf–13348, pp. 53-57) **The corrosion kinetics of borosilicate glasses for radioactive waste disposal.** Curti, E. (Paul Scherrer Inst. (PSI), Villigen (Switzerland)). Paul Scherrer Inst. (PSI), Villigen (Switzerland). 1992. 74p. In *Paul Scherrer Institut annual report 1991: Annex IV: PSI nuclear energy research. Progress report 1991.* Order Number DE93000807. Source: OSTI; NTIS; INIS.

Borosilicate glasses will probably be used as immobilization matrix for toxic nuclides in the Swiss repository for high-level radioactive waste. The major threat to the resistance of these glasses is aqueous corrosion, which was found to proceed at rates inversely proportional to the concentration of silic acid in the contacting solution. Conventional glass corrosion models cannot be used to predict the release of radionuclides in the repository environment, since they do not consider the influence of diffusive transport and sorption of silica in the compacted bentonite

surrounding the glass. An alternative model, developed at PSI, provides a tool for estimating these effects. This model predicts an acceptable acceleration of the glass degradation if realistic parameters for silica sorption in bentonite are used. Fully realistic predictions, however, remain unachievable, because other processes regulating the silica concentration in solution (such as the dissolution and precipitation of silicates) cannot be modelled using present knowledge. (author) 4 figs., 13 refs.

245 (KAERI/RR–1014/91) **A study on the treatment of industrial wastewater containing heavy metals.** Yoon, Myung Hwan (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Chang, In Soon; Choi, Chang Shik; Lee, Yoon Hwan; Hwang, Doo Sung; Shin, Jin Myung; Jung, Young Won; Ko, Yong Sang; Han, Phil Soon. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Jul 1991. 126p. (In Korean). Order Number DE93605924. Source: OSTI; NTIS (US Sales Only); INIS.

The main R.T.=28,29,30 min. components of acornic acid are separated by column chromatography and analyzed by HPLC. According to the precipitation effects of each component of acornic acid in the U.N.H.-U solution, it is considered that the main R.T.=28,29,30 min. components play an important role in the U.N.H.-U precipitation. Meanwhile, as a result of the treatment of the wastewater containing lead, cadmium and mercury, respectively by using acornic acid, the optimum pH for mixing sequence shows pH=10, and it is possible to treat lead and cadmium near upon the effluent limitations by using acornic acid. (Author).

246 (KAERI/RR–1054/91) **Microbial treatment of aqueous wastes.** Lee, Kang Suk (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Chun, Ki Jung; Kim, Kug Chan; Choi, Yong Ho; Kim, Jin Kyu; Kim, In Gyu; Park, Hyo Koo; Lee, Keun Bae. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Jan 1992. 57p. (In Korean). Order Number DE93605917. Source: OSTI; NTIS (US Sales Only); INIS.

Uranium accumulated extracellularly on the surface of Rhodobacter capsulata and Rhodospirillum rubrum cells. The rate and extent accumulation were subject to environmental parameter such as pH, temperature, carbon source, trace element and interference by certain cations. Uranium accumulation by the cells was rapid and metabolism was not required for uranium uptake by both organism. Cell-bound uranium reached concentration of 22% (Rhodospirillum rubrum) and 24% (Rhdobacter capsulata)of the dry cell weight, but in the cells grown in the presence of inhibitory concentration of $CoCl_2$, cell-bound uranium reached concentration of 27% (Rhodospirillum rubrum) and 29% (Rhodobacter capsulata) of dry cell weight. (Author).

247 (KTM/E-B–101) **JYT - Publicly financed nuclear waste management research programme: Annual report 1990.** Vuori, S. (ed.). Technical Research Centre of Finland, Espoo (Finland). Jul 1991. 119p. Order Number DE93604008. Source: OSTI; NTIS; INIS.

The nuclear waste management research in Finland is funded both by the state and the utilities (represented in cooperation by the Nuclear Waste Commission of the Finnish power companies). A coordinated research programme (JYT) comprising the publicly financed waste management studies was started in 1989 and continues until 1993. The utilities continue to carry out a parallel research programme according to their main financial and operational responsibility for nuclear waste management. The research programme covers the following main topic areas: (1) Bedrock characteristics, groundwater and repository, (2) Release and transport of radionuclides, (3) Performance and safety assessment of repositories, and (4) Waste management technology and costs.

248 (NSS/R–128) **Near-field solubility studies.** Thomason, H.P.; Williams, S.J. AEA Decommissioning and Radwaste, Harwell (United Kingdom); United Kingdom Nirex Ltd., Harwell (United Kingdom). Feb 1992. 46p. (AEA-D and R–0068.). Order Number DE93605943. Source: OSTI; NTIS (US Sales Only); INIS.

Experimental determinations of the solubilities of americium, plutonium, neptunium, protactinium, thorium, radium, lead, tin, palladium and zirconium are reported. These elements have radioactive isotopes of concern in assessments of radioactive waste disposal. All measurements were made under the highly alkaline conditions typical of the near field of a radioactive waste repository which uses cementitious materials for many of the immobilisation matrices, the backfill and the engineered structures. Low redox potentials, typical of those resulting from the corrosion of iron and steel, were simulated for those elements having more than one accessible oxidation state. The dissolved concentrations of the elements were defined using ultrafiltration. In addition, the corrosion of iron and stainless steel was shown to generate low redox potentials in solution and the solubility of iron(II) at high pH was measured and found to be sufficient for it to act as a redox buffer with respect to neptunium and plutonium. (author).

249 (NSS/R–258) **Studies of the effects of organic materials on the sorption of uranium(IV) and thorium(IV) on London clay and Caithness flagstones.** Baston, G.M.N.; Berry, J.A.; Bond, K.A.; Brownsword, M.; Linklater, C.M. AEA Decommissioning and Radwaste, Harwell (United Kingdom); United Kingdom Nirex Ltd., Harwell (United Kingdom). Aug 1991. 30p. (AEA-D and R–0210.). Order Number DE93605944. Source: OSTI; NTIS (US Sales Only); INIS.

The effects of the presence of cellulosic degradation products on the sorption of uranium (IV) and thorium(IV) on London clay and Caithness flagstones have been studied using the batch sorption method. Experimental conditions were chosen to simulate both those expected close to a cementitious repository (pH $\approx$11) and at the edge of the zone of migration of the alkaline plume (pH $\approx$ 8). Work was carried out (i) under baseline conditions, in the absence of organic materials; (ii) with 2×10^{-3}M gluconate, acting as a well-characterised degradation product simulant; (iii) with authentic degradation products. The results show that the presence of authentic degradation products has a small effect on sorption and the presence of gluconate at a high concentration has a marked impact. (author).

250 (NSS/R–260) **Preliminary modelling studies of the migration and sorption of radioelements in the far field of a nuclear waste repository.** Brown, P.L.; Gabriel, D.S.; Haworth, A.; Sharland, S.M.; Smith, A.C.; Tweed, C.J. AEA Decommissioning and Radwaste, Harwell (United Kingdom); United Kingdom Nirex Ltd., Harwell (United Kingdom). Dec 1991. 32p. (AEA-D and R–0123.). Order Number DE93605945. Source: OSTI; NTIS (US Sales Only); INIS.

The development of a model of the migration of dissolved radionuclides through a porous, sorbing material is presented. A surface-complexation model of sorption processes is coupled with a transport simulation using the CHEQMATE code. The chemical model has been shown to reproduce trends observed in batch sorption experiments reasonably well. In this paper, the coupled model is applied to a number of through-diffusion experiments for radioelements, in both the presence and absence of a complexing organic ligand, gluconate (intended to act as a well-characterised simulant of the degradation products arising from cellulosic organic components in the waste). The systems simulated include uranium diffusing through London clay and uranium and plutonium through St Bees sandstone. The simulations of the experiments that include gluconate are compared with observed breakthrough curves. The breakthrough curve for uranium in London clay is in good agreement with the experiment, but for sandstone the agreement is not good. The sandstone model will be refined when more experimental data become available. The model will later be used to investigate possible limitations to the simple K_D approach used in repository safety-assessment modelling. (author).

251 (ORNL/ER–122) **Characterization of secondary solid waste anticipated from the treatment of trench water from Waste Area Grouping 6 at Oak Ridge National Laboratory, Oak Ridge, Tennessee: Environmental Restoration Program.** Kent, T.E.; Taylor, P.A. Oak Ridge National Lab., TN (United States). Environmental Restoration Div. Sep 1992. 31p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92040848. Source: OSTI; NTIS; INIS; GPO Dep.

This project was undertaken to demonstrate that new liquid waste streams, generated as a consequence of closure activities at Waste Area Grouping (WAG) 6, can be treated adequately by

existing wastewater treatment facilities at Oak Ridge National Laboratory (ORNL) without producing hazardous secondary solid wastes. Previous bench-scale treatable studies indicated that ORNL treatment operations will adequately remove the contaminants although additional study was required in order to characterize the secondary waste materials produced as a result of the treatment A 0.5-L/min pilot plant was designed and constructed to accurately simulate the treatment capabilities of ORNL fill-scale (490 L/min) treatment facilities-the Process Waste Treatment Plant (PWTP) and Nonradiological Wastewater Treatment Plant (NRWTP). This new test system was able to produce secondary wastes in the quantities necessary for US Environmental Protection Agency toxicity characteristic leaching procedure (TCLP) testing. The test system was operated for a 45-d test period with a minimum of problems and downtime. The pilot plant operating data verified that the WAG 6 trench waters can be treated at the PWTP and NRWTP to meet the discharge limits. The results of TCLP testing indicate that none of the secondary solid wastes will be considered hazardous as defined by the Resource Conservation and Recovery Act.

252 (ORNL/RAP/Sub–86-72139/2) **Preliminary geohydrologic site characterization and proposed water quality well locations for WAG 7, WAG 8 and WAG 9.** Baughn, D.C. (MCI/Consulting Engineers, Inc., Knoxville, TN (United States)). Oak Ridge National Lab., TN (United States); MCI/Consulting Engineers, Inc., Knoxville, TN (United States). Sep 1987. 287p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93000502. Source: OSTI; NTIS; GPO Dep.

The purpose of this report is to assess general site conditions and to recommend water quality well locations at three Waste Area Groupings (WAGS) within the Oak Ridge National Laboratory (ORNL) complex. The subject sites are WAGs 7, 8 and 9 each of which is identified on the general site location map. For reference, the relationship of the subject sites to other WAGs are shown. WAGs are regions prescribed by Martin Marietta throughout the ORNL complex that require environmental assessment. WAGs contain solid waste management units such as Solid Waste Storage Areas (SWSAs), as well as pipelines, spill sites, buildings, ponds and experimental test sites. These solid waste management units are considered to be potential sources of contamination. The WAG boundaries describe the areal limits of specific waste management operations as well as currently known areas of waste constituent migration. Because solid waste management units within WAGs 7, 8 and 9 may continue to release waste constituents to the environment, the existing groundwater monitoring systems is being upgraded. This report recommends locations for water quality wells which will be installed at these three WAG boundaries in order to gather water quality data. The proposed well locations are shown. Water quality well design coordinates (ORNL grid) and estimated completion depths are given.

253 (PNL–8047) **Minutes of the Tank Waste Science Panel meeting, November 11–13, 1991: Hanford Tank Safety Project.** Strachan, D.M. (comp.). Pacific Northwest Lab., Richland, WA (United States). Apr 1992. 317p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-9111267–: Tank waste science panel, Pasco, WA (United States), 11-13 Nov 1991). Order Number DE93001271. Source: OSTI; NTIS; INIS; GPO Dep.

The sixth meeting of the Tank Waste Science Panel was held November 11–13, 1991, in Pasco and Richland, Washington. Participating scientists presented the results of recent work on various aspects of issues relating to the generation and release of gases from Tank 241-SY-101 and the presence of ferrocyanide in other tanks at Hanford. Results are discussed.

254 (PNL–8048) **Minutes of the Tank Waste Science Panel meeting July 9–1, 1991: Hanford Tank Safety Project.** Strachan, D.M. (comp.). Pacific Northwest Lab., Richland, WA (United States). Apr 1992. 243p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93001272. Source: OSTI; NTIS; INIS; GPO Dep.

The fifth meeting of the Tank Waste Science Panel was held July 9–11, 1991, in Atlanta, Georgia. The subject areas included the generation, retention, and release of gases from Tank 241-SY-101 and the chemistry of ferrocyanide wastes.

255 (PNL–8338) **Hydrogen Safety Project: Chemical analysis support task: Window "E" analyses.** Jones, T.E.; Campbell, J.A.; Hoppe, E.W.; Greenwood, L.R.; Gillespie, B.M. Pacific Northwest Lab., Richland, WA (United States). Sep 1992. 986p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93001658. Source: OSTI; NTIS; INIS; GPO Dep.

Core samples taken from tank 101-SY at Hanford during "window E" were analyzed for organic and radiochemical constituents by staff of the Analytical Chemistry Laboratory at Pacific Northwest Laboratory. Westinghouse Hanford company submitted these samples to the laboratory.

256 (PNL-SA–20520) **Second-order model selection in mixture experiments.** Redgate, P.E.; Piepel, G.F.; Hrma, P.R. Pacific Northwest Lab., Richland, WA (United States). Jul 1992. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-920893–5: Joint statistical meetings of the American Statistical Association, the Biometric Society and the Institute of Mathematical Statistics, Boston, MA (United States), 9-13 Aug 1992). Order Number DE92041334. Source: OSTI; NTIS; GPO Dep.

Full second-order models for q-component mixture experiments contain q(q+l)/2 terms, which increases rapidly as q increases. Fitting full second-order models for larger q may involve problems with ill-conditioning and overfitting. These problems can be remedied by transforming the mixture components and/or fitting reduced forms of the full second-order mixture model. Various component transformation and model reduction approaches are discussed. Data from a 10-component nuclear waste glass study are used to illustrate ill-conditioning and overfitting problems that can be encountered when fitting a full second-order mixture model. Component transformation, model term selection, and model evaluation/validation techniques are discussed and illustrated for the waste glass example.

257 (PNL-SA–20941) **Pretreatment process testing of Hanford tank waste for the US Department of Energy's Underground Storage Tank Integrated Demonstration.** Jones, E.O. (Pacific Northwest Lab., Richland, WA (United States)); Colton, N.G.; Bloom, G.R.; Barney, G.S.; Colby, S.A.; Cowan, R.G. Pacific Northwest Lab., Richland, WA (United States). Apr 1992. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-920851–75: Spectrum '92: nuclear and hazardous waste management international topical meeting, Boise, ID (United States), 23-27 Aug 1992). Order Number DE92041328. Source: OSTI; NTIS; INIS; GPO Dep.

Work conducted for the Underground Storage Tank Integrated Demonstration supports technology demonstration for tank remediation operations at the US Department of Energy's (DOE) Hanford Site and other DOE sites. Several technical areas within the demonstration are being investigated by the Waste Pretreatment Technology Development task to support final treatment and disposal of Hanford tank waste. The experimental work includes waste characterizations; dissolution, leaching and extraction tests; bulk salt separations by freeze crystallization; and radiochemical separations with extraction chromatography resins. Chemical species and particle size data provide background information for interpreting waste leaching and dissolution data. Tie major crystalline phases in one single-shell tank (SST) waste are sodium nitrate and bismuth phosphate, while the major phases in another SST waste are boehmite, gibbsite, and sodium nitrate. A scanning electron microscopy (SEM) method of particle size analysis shows that many of the sub-micron particles in the two SST wastes appear to be aggregates of smaller, spheroidal particles. In turn, leaching, dissolution, and extraction studies, performed with tank wastes, provide fundamental information needed to evaluate existing pretreatment technologies. Preliminary results from the dissolution of one SST waste indicate that 2M nitric acid may effectively leach enough transuranic material that the sludge could be disposed of as low level waste.

258 (PNL-SA-21009) **Radioactive waste vitrification technology.** Burkholder, H.C.; Chapman, C.C.; Ross, W.A.; Thompson, L.E. Pacific Northwest Lab., Richland, WA (United States). Sep 1992. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-9209108-2: 3. annual meeting of USSR Nuclear Society, St. Petersburg (Russian Federation), 14-18 Sep 1992). Order Number DE93001516. Source: OSTI; NTIS; INIS; GPO Dep.

This report discusses the involvement of the Pacific Northwest Laboratory in the development of vitrification technology for the treating of radioactive, chemical and mixed wastes since the 1960's.

259 (PNL-SA-21233) **Resolution of safety issues associated with the storage of high-level radioactive waste at the Hanford Site.** Mellinger, G.B. (Pacific Northwest Lab., Richland, WA (United States)); Tseng, J.C. Pacific Northwest Lab., Richland, WA (United States). Aug 1992. 23p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-920808-10: American Institute of Chemical Engineers (AIChE) summer national meeting, Minneapolis, MN (United States), 9-12 Aug 1992). Order Number DE92041332. Source: OSTI; NTIS; INIS; GPO Dep.

A number of high-level radioactive waste (HLW) safety issues have been identified at the Hanford Site in southeastern Washington State. Resolution of these issues is one of the Highest Priorities of the US Department of Energy. The most urgent issues are the potential for explosions in certain tanks (due to periodic venting of large quantities of flammable gases, or the presence of substantial quantities of ferrocyanide and/or organic compounds in combination with nitrates-nitrites). Other safety issues have been identified as well, such as the requirement for periodic water additions to one tank to control its temperature and the release of noxious vapors from a number of tanks. Substantial progress has been made toward safety issue resolution. Potential mechanisms have been identified for the generation, retention and periodic venting of flammable gas mixtures; potential methods for controlling the periodic release behavior have been identified and in-tank testing will be initiated in 1992. Research is being conducted to determine the initiation temperatures, energetics, reaction sequences and effects of catalysts and initiators on ferrocyanide-nitrate/nitrite reactions; waste characterization on a tank-by-tank basis will be required to identify whether ferrocyanide-containing wastes are safe to store as-is or will require further treatment to eliminate safety concerns. Resolution of all of the Hanford Site HLW safety issues will be accomplished as an integral part of the Hanford Tank Waste Remediation System, that has been established to manage the storage of these wastes and their preparation for disposal.

260 (RFP-4485) **Liquefaction and storage of thermal treatment off-gases.** Stull, D.M. (EG and G Rocky Flats, Inc., Golden, CO (United States). Rocky Flats Plant); Golden, J.O. EG and G Rocky Flats, Inc., Golden, CO (United States). Rocky Flats Plant. 8 Sep 1992. 24p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC34-90DP62349. Order Number DE93001883. Source: OSTI; NTIS; GPO Dep.

A fluidized bed catalytic oxidation unit is being developed for use in the destruction of mixed waste at the Rocky Flats Plant. Cyclones, filters, in situ neutralization of acid gases, and a catalytic converter are used to meet emission standards. Because there is concern by the public that these measures may not be adequate, two off-gas capture systems were evaluated. Both systems involve liquefaction of carbon dioxide produced in the oxidation process. The carbon dioxide would be released only after analysis proved that all appropriate emission standards are met.

261 (SAND-91-2416) **LLUVIA-II: A program for two-dimensional, transient flow through partially saturated porous media: Yucca Mountain Site Characterization Project.** Eaton, R.R.; Hopkins, P.L. Sandia National Labs., Albuquerque, NM (United States). Aug 1992. 53p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93001349. Source: OSTI; NTIS; INIS; GPO Dep.

LLUVIA-II is a program designed for the efficient solution of two-dimensional transient flow of liquid water through partially saturated, porous media. The code solves Richards equation using the method-of-lines procedure. This document describes the solution procedure employed, input data structure, output, and code verification.

262 (SAND-91-7071) **Consolidation of the Waste Isolation Pilot Plant crushed salt/bentonite mixtures as a function of confining pressure and moisture content as compared with constitutive model predictions.** Brodsky, N.S. (RE/SPEC, Inc., Rapid City, SD (United States)); Pfeifle, T.W. Sandia National Labs., Albuquerque, NM (United States); RE/SPEC, Inc., Rapid City, SD (United States). Jul 1992. 63p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93001801. Source: OSTI; NTIS; INIS; GPO Dep.

Four hydrostatic consolidation tests were performed on crushed salt/bentonite mixtures to evaluate the influence of moisture on consolidation rate, permeability, and compressive strength. Specimens comprised 30 percent bentonite and 70 percent salt based on total dry weight. Brine was added to each specimen to adjust its total moisture content to between 3.5 and 10 percent (nominal) of the total dry weight. In the consolidation tests, each specimen was subjected to two stages of hydrostatic stress: 0.5 MPa and 3.45 MPa. During each stage, the pressure was maintained at a constant level and volumetric strain data were continuously logged. By using multiple stages, consolidation data were obtained at two pressures and the time required to consolidate the specimens to full saturation was reduced. Once full saturation was achieved, specimens were subjected to a final test stage in which the hydrostatic stress was reduced and a permeability test was performed. A steady flow permeability test was performed successfully on only one specimen and its permeability was determined to be 1.12×10^{-19} m^2. An unconfined compressive strength test was conducted on one of the consolidated specimens and was found to be 1.66 MPa. A density model proposed by Sjaardema and Krieg was compared to the dry density data using parameter values established by Callahan and DeVries. The model fit the data best at intermediate moisture contents and low pressures. The model was also fitted to the data obtained in this study to determine additional parameter values.

263 (SAND-91-7099) **Waste Isolation Pilot Plant: Alcove Gas Barrier trade-off study.** Lin, M.S. (Parsons, Brinckerhoff, Quade and Douglas, Inc., San Francisco, CA (United States)); Van Sambeek, L.L. Sandia National Labs., Albuquerque, NM (United States); Parsons, Brinckerhoff, Quade and Douglas, Inc., San Francisco, CA (United States); RE/SPEC, Inc., Rapid City, SD (United States). Jul 1992. 231p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93001802. Source: OSTI; NTIS; INIS; GPO Dep.

A modified Kepner-Tregoe method was used for a trade-off study of Alcove Gas Barrier (AGB) concepts for the Waste Isolation Pilot Plant. The AGB is a gas-constraining seal to be constructed in an alcove entrance drift. In this trade-off study, evaluation criteria were first selected. Then these criteria were classified as to their importance to the task, assigning a weighting value to each aspect. Eleven conceptual design alternatives were developed based on geometrical/geological considerations, construction materials, constructibility, and other relevant factors and evaluated.

264 (SAND-92-0685C) **Overview of waste component recycle, treatment, and disposal integrated demonstration (WeDID) activities.** Wheelis, W.T. Sandia National Labs., Albuquerque, NM (United States). [1992]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-921090-1: International symposium on energetic materials technology: demilitarization, New Orleans, LA (United States), 4-7 Oct 1992). Order Number DE92040268. Source: OSTI; NTIS; INIS; GPO Dep.

Over the last year it has become apparent that there will be a reduction of nuclear weapon stockpiles in both the United States (US) as well as the Commonwealth of Independent States (CIS; formerly the Soviet Union). To meet these requirements in the United States will necessitate the dismantlement and safe disposal, in accordance with Environmental Protection Agency (EPA) guidelines, of a wide variety of types of components (representing more than 30 years of hardware development). The primary regulatory driver for these components is the Resource Conservation and Recovery Act (RCRA). Weapon components contain hazardous materials (e.g.,

heavy metals), PCBs, self-contained explosives, radioactive materials, gas-filled tubes, etc. Because of the wide range of materials found in these components, processes that are technologically robust (i.e., can handle the wide variation of weapon component materials), are cost-effective, recycle as much material as possible, provide true waste minimization, and are fully regulatory compliant are needed. The Waste Component Recycle, Treatment, and Disposal Integrated Demonstration (WeDID) is examining issues in these areas and demonstrating technologies that can be used for the safe disposal of the non-nuclear components of a nuclear weapon. The methods and technologies developed by WeDID for US weapon components would be directly applicable to CIS components. WeDID is a Department of Energy (DOE), Environmental Restoration and Waste Management (ERWM) sponsored program. The goal of WeDID is, to demonstrate the end-to-end disposal process for Sandia National Laboratory designed weapon components. It is anticipated that WeDID can demonstrate true waste minimization by recycling at least 30% (by total component weight) of the metals found in these components, and destruction of at least 30% of the organic materials typically found in a weapon component.

265 (SAND–92-1275) **Thermal diffusion processes in aqueous sodium chloride solutions.** Cygan, R.T. (Sandia National Labs., Albuquerque, NM (United States)); Jarrell, G.D. Sandia National Labs., Albuquerque, NM (United States). 18 Aug 1992. 36p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93002596. Source: OSTI; NTIS; INIS; GPO Dep.

The experimental results for the Soret coefficients are variable, but suggest a trend with NaCl concentration that is consistent with electrolyte solution behavior. The temperature dependence of the Soret coefficients is in approximate agreement with previous measurements obtained using other techniques. In general, the Soret coefficient values are best interpreted based on the expansion of the fluid inclusion migration fields. The high temperature values for σ at 1.0 N NaCl concentration suggest an expansion of the migration field to smaller inclusion sizes, which for a single halite crystal at these conditions, approach a dimension of one micron. The corresponding fluid inclusion size for the polycrystalline material, where grain boundaries retard the migration, is approximately 10 microns. Although the Soret results obtained in the present study provide additional data for high temperature applications in nuclear waste isolation, more experimentation and new equipment design are required in order to obtain data at temperatures above 80°C. The experimental approach utilized in this study is limited in that respect. The almost immeasurable nature of the thermal diffusion process for the brines as examined in the laboratory, suggests that this effect will be insignificant (outside of fluid inclusion migration) in most rock-water interactions associated with a rocksalt nuclear waste repository. Other effects, such as convective fluid transport, pressure solution, and groundwater flow, will be orders-of-magnitude more important in evaluating the critical nature of brine migration, waste canister corrosion, and the potential for leaching radioisotopes from waste repositories.

266 (SKB-TR–91-64) **SKB annual report 1991. Including summaries of technical reports issued during 1991.** Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden). May 1992. 195p. Order Number DE93604009. Source: OSTI; NTIS; INIS.

This is the annual report on the activities of the Swedish Nuclear Fuel and Waste Management Co., SKB. SKB is the owner of CLAB, the central facility for interim storage of spent nuclear fuel, located at Oskarshamn. CLAB was taken into operation in July 1985 and to the end of 1991 in total 1514 tonnes of spent fuel (measured as uranium) have been received. Transportation from the nuclear sites to CLAB is made by a special ship, M/S Sigyn. At Forsmark the final repository for Radioactive Waste (SFR) was taken into operation in April 1988. The repository is situated in crystalline rock under the Baltic Sea. The first construction phase includes rock caverns for 60000 m^3 of waste. A second phase for additional 30000 m^3 is planned to be built and commissioned around the year 2000. At the end of 1991 a total of 7900 m^3 of waste have been deposited in SFR. SKB is in charge of a comprehensive research and development programme on geological disposal of nuclear waste. The total cost for R and D during 1991 was 182.7 MSEK of which 15.9 MSEK came from participants outside Sweden. Geological site-investigations are a substantial part of the programme. SKB is also the managing participant of the international Stripa-project under OECD/NEA. Cost calculations for the total nuclear waste management system, including decommissioning of all reactors, are updated annually. The total cost is estimated to 55 billion SEK. SKB also handles matters pertaining to prospecting and enrichment as well as stockpiling of uranium as strategic reserves for the Swedish nuclear power industry. Consulting service from SKB and associated expert groups are available on a commercial basis. Information activities are an integrated and important part of the Swedish radioactive waste management system. During 1991 successful public information activities have been carried out using mobile exhibitions in a tailor-made trailer and on the SKB ship M/S Sigyn. (au).

267 (SKB-TR–92-03) **Numerical groundwater flow calculations at the Finnsjoen study site - extended regional area.** Lindbom, B. (Kemakta Consultants Co., Stockholm (Sweden)); Boghammar, A. Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden). May 1992. 66p. Order Number DE93604010. Source: OSTI; NTIS; INIS.

The present report describes modelling efforts of the groundwater flow situation at the Finnsjoen site in northern Uppland, approximately 140 km north of Stockholm. The study forms part of the SKB 91 performance assessment project, and aims at describing the travel times and travel paths from a potential repository for spent nuclear fuel located in crystalline rock, and also to calculate the flux values at repository level. The groundwater flow equations were solved with the finite element technique and made use of the NAMMU-code for stationary calculations in three dimensions. The calculations aimed at identifying a reference case from which the boundary pressures were to be extracted and used as input for future calculations with the HYDRASTAR-code, which is based on the stochastic continuum approach. The study also comprises an analysis to investigate the model sensitivity to the conductivity contrast between rock mass and fracture zones, the sensitivity to the presence of sub-horizontal fracture zones, and the degree of establishment of the discharge area. The fracture zones were modelled implicitly with an averaging technique. (8 refs., 58 figs.) (au).

268 (SKN–56) **International development within the spent nuclear fuel cycle.** Aggeryd, I. (Studsvik Nuclear, Nykoeping (Sweden)); Broden, K. National Board for Spent Nuclear Fuel, Stockholm (Sweden); Studsvik Nuclear, Nykoeping (Sweden). Mar 1992. 78p. (In Swedish). (STUDSVIK-NW–91-70.). Order Number DE93603992. Source: OSTI; NTIS; INIS.

The report gives a survey of the nerest international development. The waste management, final disposal and waste minimization are discussed more in details. (148 refs.).

269 (SKN–60) **Survey of siting practices for selected management projects in seven countries.** Hardin, E. (Swedish Engineering Services (SINTAB), Bromma (Sweden)); Aahagen, H. National Board for Spent Nuclear Fuel, Stockholm (Sweden). Jun 1992. 110p. Order Number DE93604011. Source: OSTI; NTIS; INIS.

This paper surveys siting practices for deep geologic disposal in seven countries, and attempts to formulate generalizations which could be useful for the upcoming review of the Swedish plan for siting the SFL repository (R and D 92). Comparison of projects in different countries is done with full appreciation of the technical, legal, and cultural differences. The seven countries were selected for experience with siting in crystalline rock, similarity of siting practices to Sweden, and the availability of published information. Local governments have demonstrated effective veto power in each of the seven countries surveyed, although this power is exercised in different ways. This paper shows how the siting strategy itself affects the ability and the inclination of localities to block the project. It shows by example that public involvement, parallel vs. sequential characterization, schedule for siting activities, and the existence of interim waste storage capability have an impact on the success of siting. The focus of this paper is deep geologic disposal. Shallow land disposal and non-radioactive wastes are not discussed in detail, with three exceptions: LLW disposal siting in the U.S. and

Canada, and the SAKAB incinerator projects in Sweden. These provide insight into siting approaches and demonstrate that conclusions regarding deep geologic disposal are supported by other experience. (114 refs.) (au).

270 (SKN–61) **SKNs continued review of predictions and validations in connection with the Aespoe hard rock laboratory.** Palmqvist, K. (Berggeologiska Undersoekningar AB (BERGAB) (Sweden)); Hargelius, H.; Sundquist, U. National Board for Spent Nuclear Fuel, Stockholm (Sweden). Jun 1992. 244p. (In Swedish). Order Number DE93604012. Source: OSTI; NTIS; INIS.

Presents a review of the prediction and validation work the Swedish Nuclear Fuel and Waste Management Company (SKB) has done concerning the Aespoe hard rock laboratory. (39 refs.).

271 (SKN–65) **Comments on the SKB research and development work since 1984 - an overview.** Andersson, Kjell (KARINTA-KONSULT (Sweden)). National Board for Spent Nuclear Fuel, Stockholm (Sweden). Jun 1992. 125p. (In Swedish). Order Number DE93604013. Source: OSTI; NTIS; INIS.

Presents comments on the Swedish research and development programs concerning the management and disposal of high-level radioactive wastes. The comments are given by institutions and authorities.

272 (UCRL-ID–111665) **Study of plutonium volatility under microwave melting conditions used for glass encapsulation of plutonium sludge wastes: An interim report.** Krikorian, O.H.; Condit, R.H.; Fontes, A.F.; Morris, W.F.; Magana, J.W. Lawrence Livermore National Lab., CA (United States). 25 Sep 1992. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE93001827. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Experimental studies have just gotten underway to estimate the extent of Pu volatility occurring during the microwave melting process for glass encapsulation of plutonium sludge wastes. Two tests were conducted for melt temperatures of 1338 and 1435 K.and gave Pu volatilities of 1.3×10^{-10} and 2.1×10^{-10} atm, respectively.

273 (WHC-EP–0474-5) **Quarterly report on Defense Nuclear Facilities Safety Board Recommendation 90-7 for the period ending June 30, 1992.** Cash, R.J.; Dukelow, G.T. Westinghouse Hanford Co., Richland, WA (United States). Jul 1992. 130p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92040797. Source: OSTI; NTIS; GPO Dep.

This is the fifth quarterly report on the prgress of activities addressing safety issues associated with Hanford Site high-level radioactive waste tanks that contain ferrocyanide compounds.

274 (WHC-EP–0524) **Waste Tank Safety and Operations Program management plan.** Mares, E.F. Westinghouse Hanford Co., Richland, WA (United States). Jan 1992. 553p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92040479. Source: OSTI; NTIS; INIS; GPO Dep.

This document establishes the Waste Tank Safety and Operations Program; the basis for the program; the procedures for managing the work and the policies to be followed when changing the scope of work. It presents the fiscal year 1992 scope of work, schedule, and cost baselines in the form of a Revised Fiscal Year 1992 Work Plan which is a requirement of the Site Management System. Likewise, it establishes the program objectives, quality assurance requirements, defines internal and external program interfaces; establishes the program management procedures; defines the change control policy; and presents the milestones to be accomplished.

275 (WINCO–11876) **Remote ignitability analysis of high level radioactive wastes.** Lundholm, C.W.; Morgan, J.M.; Shurtliff, R.M.; Trejo, L.E. Westinghouse Idaho Nuclear Co., Inc., Idaho Falls, ID (United States). [1992]. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-84ID12435. (CONF-9210110–1: 33. Oak Ridge National Laboratory/Department of Energy conference on analytical chemistry in energy technology, Gatlinburg, TN (United States), 6-8 Oct 1992). Order Number DE92041323. Source: OSTI; NTIS; INIS; GPO Dep.

The Remote Analytical Laboratory (RAL) at the Idaho National Engineering Laboratory (INEL) is involved in selected regulatory RCRA analyses of high level radioactive wastes. The requirement for characterization of the wastes at the INEL dictated the need for a remote ignitability determination. An ERDCO Model RT-1 Ignitability Tester was extensively modified for remote analysis in the RAL Hot Cell which uses Master Slave manipulators for sample handling and instrument operation. The modifications to the ERDCO instrument were required because of observation problems and remote sample/instrument handling in the hot cell. Highlights of the modifications for remote operation are as follows: a piezo film sensor was added for flash/nonflash detection, a mass flow controller and a thermocouple flame detector were added to ensure flame consistency and ignition, and a small stepper motor was used to activate the shutter. Design features of the remote ignitability instrument and remote sampling techniques are discussed.

276 (WSRC-MS–92-324) **Factors affecting the rate of hydrolysis of phenylboronic acid in lab-scale precipitate reactor studies.** Bannochie, C.J.; Marek, J.C.; Eibling, R.E.; Baich, M.A. Westinghouse Savannah River Co., Aiken, SC (United States). [1992]. 26p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. (CONF-9209226–1: Emerging technologies in hazardous waste management, Atlanta, GA (United States), 21-23 Sep 1992). Order Number DE93000472. Source: OSTI; NTIS; INIS; GPO Dep.

Removing aromatic carbon from an aqueous slurry of cesium-137 and other alkali tetraphenylborates by acid hydrolysis will be an important step in preparing high-level radioactive waste for vitrification at the Savannah River Site's Defense Waste Processing Facility (DWPF). Kinetic data obtained in bench-scale precipitate hydrolysis reactors suggest changes in operating parameters to improve product quality in the future plant-scale radioactive operation. The rate-determining step is the removal of the fourth phenyl group, i.e. hydrolysis of phenylboronic acid. Efforts to maximize this rate have established the importance of several factors in the system, including the ratio of copper(II) catalyst to formic acid, the presence of nitrite ion, reactions of diphenylmercury, and the purge gas employed in the system.

277 (WSRC-RP–89-898-Vol.1) **Waste management units - Savannah River Site: Volume 1, Waste management unit worksheets.** Westinghouse Savannah River Co., Aiken, SC (United States). Oct 1989. 295p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE92040052. Source: OSTI; NTIS; INIS; GPO Dep.

This report is a compilation of worksheets from the waste management units of Savannah River Plant. Information is presented on the following: Solid Waste Management Units having received hazardous waste or hazardous constituents with a known release to the environment; Solid Waste Management Units having received hazardous waste or hazardous constituents with no known release to the environment; Solid Waste Management Units having received no hazardous waste or hazardous constituents; Waste Management Units having received source; and special nuclear, or byproduct material only.

278 (WSRC-RP–90-1055-Rev.1) **Task plan for test of PRBT prototypic liquid sampler: Revision 1.** Jenkins, W.J. Westinghouse Savannah River Co., Aiken, SC (United States). 3 Feb 1992. 32p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE93001358. Source: OSTI; NTIS; INIS; GPO Dep.

The primary objective of this task is to determine just how representative Precipitate Reactor Bottom Tank (PRBT) samples taken from the Hydragard™ prototypic liquid sampler are of the in-tank contents and also to determine the homogeneity of the in-tank contents. This shall be accomplished by a statistical design study sampling plan for paired contrasts of the analysis results of samples taken from: (1) the Hydragard™ prototypic liquid sampler paired with the more fundamental grab sampler at the lower elevation for the Hydragard™ prototypic liquid sampler accuracy and (2) the grab sampler at the lower elevation paired with the grab sampler at the upper elevation for the in-tank homogeneity. These

measurements are paired together to sharpen the contrast so that, as nearly as possible, only the conditions of the effect under study will differ between the two. This "split-plot" arrangement provides increased precision for the contrast under study by canceling out common extraneous effects, thereby enabling the detection of smaller effects. The secondary objective of the task is to determine the level of influence of the major contributors to the overall uncertainty in the sample preparation and measurement process. These major steps include: preparation method (H_2SO_4-HF Titanium dissolution); aliquoting and dilution within a dissolution; measurement and long-term behavior of the ICP and AA instruments, as monitored by the measurement of standards and blanks embedded within each block of samples for the measurement sequence. This sampling task, therefore, is mostly devoted to determining the sampler characteristics and is not intended to provide a comprehensive estimate of the overall uncertainty affecting DWPF sample analysis in routine operation.

279 (WSRC-TR–91-648) **Estimates of DWPF canister production.** Plodinec, M.J. Westinghouse Savannah River Co., Aiken, SC (United States). 6 Dec 1991. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE92040818. Source: OSTI; NTIS; INIS; GPO Dep.

Specification 1.2 of the repository program's Waste Acceptance Preliminary Specifications requires that the DWPF estimate the radionuclide inventory, and provide the error of the estimate, for each waste type (assumed to be each sludge batch). The inventory of any radionuclide is directly proportional to the number of canisters produced from that sludge batch. Thus, estimating the number of canisters to be produced from each sludge batch is an important part of complying with this specification. In this report, the number of canisters to be produced from each batch of sludge is estimated. This leads to the conclusion that approximately 5200 canisters will be produced by the DWPF through the year 2010. Thereafter, it is conservatively estimated that up to 124 canisters will be produced each year. The errors in these estimates are also discussed.

280 (WSRC-TR–92-260) **Inorganic analyses of volatilized and condensed species within prototypic Defense Waste Processing Facility (DWPF) canistered waste.** Jantzen, C.M. Westinghouse Savannah River Co., Aiken, SC (United States). 30 Jun 1992. 51p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE93001340. Source: OSTI; NTIS; INIS; GPO Dep.

The high-level radioactive waste currently stored in carbon steel tanks at the Savannah River Site (SRS) will be immobilized in a borosilicate glass in the Defense Waste Processing Facility (DWPF). The canistered waste will be sent to a geologic repository for final disposal. The Waste Acceptance Preliminary Specifications (WAPS) require the identification of any inorganic phases that may be present in the canister that may lead to internal corrosion of the canister or that could potentially adversely affect normal canister handling. During vitrification, volatilization of mixed (Na, K, Cs)Cl, $(Na, K, Cs)_2SO_4$, $(Na, K, Cs)BF_4$, $(Na, K)_2B_4O_7$ and $(Na,K)CrO_4$ species from glass melt condensed in the melter off-gas and in the cyclone separator in the canister pour spout vacuum line. A full-scale DWPF prototypic canister filled during Campaign 10 of the SRS Scale Glass Melter was sectioned and examined. Mixed (NaK)Cl, $(NaK)_2SO_4$, (NaK) borates, and a (Na,K) fluoride phase (either NaF or Na_2BF_4) were identified on the interior canister walls, neck, and shoulder above the melt pour surface. Similar deposits were found on the glass melt surface and on glass fracture surfaces. Chromates were not found. Spinel crystals were found associated with the glass pour surface. Reference amounts of the halides and sulfates were found retained in the glass and the glass chemistry, including the distribution of the halides and sulfates, was homogeneous. In all cases where rust was observed, heavy metals (Zn, Ti, Sn) from the cutting blade/fluid were present indicating that the rust was a reaction product of the cutting fluid with glass and heat sensitized canister or with carbon-steel contamination on canister interior. Only minimal water vapor is present so that internal corrosion of the canister, will not occur.

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Refer also to citation(s) 295, 296, 613, 1544, 1562, 1576, 1577, 1578, 1579, 1580, 1581, 1636, 1662

281 (DPST–86-278) **Technetium-99 and Iodine-129 in the burial ground plume.** Oblath, S.B.; Carlton, W.H. Du Pont de Nemours (E.I.) and Co., Aiken, SC (United States). Savannah River Lab. 6 Feb 1986. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE93000520. Source: OSTI; NTIS; INIS; GPO Dep.

As anionic species, both Tc-99 and I-129 are expected to be mobile in the soils beneath the burial ground. These two isotopes were analyzed in groundwater collected from research wells screened in the tritium plume leaving the burial ground. The maximum observed concentrations of 22 pCi/L of Tc-99 and 12 pCi/L of I-129 in the plume wells are above background levels and confirm the mobility of these species. The earlier measurements included in this report have been reported before.1,2 The data indicate that the I-129 concentrations may be increasing with time. Because of the long time (greater than one year) involved in obtaining results for these ultra low-level analyses, this work included analysis of only a few wells inside the burial ground. This limited selection of wells does not permit a mapping of the groundwater concentration isopleths.

282 (DUN–1008) **Contamination control – Columbia River: Monthly report, April 1966.** Geier, R.G. Douglas United Nuclear, Inc., Richland, WA (United States). 28 Apr 1966. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93000317. Source: OSTI; NTIS (US Sales Only); GPO Dep.

It is the purpose of this report to present data obtained from the routine reactor effluent radioactivity monitoring program as well as the results obtained from the research and development program directed toward the reduction of effluent radioactivity.

283 (DUN–5030) **Contamination control, Columbia River: Quarterly report, July–September 1968.** Geier, R.G. Douglas United Nuclear, Inc., Richland, WA (United States). 15 Nov 1968. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93000318. Source: OSTI; NTIS (US Sales Only); GPO Dep.

It is the purpose of this report to present data obtained from the routine reactor effluent radioactivity monitoring program as well as the results obtained from the research and development program directed toward the reduction of effluent radioactivity.

284 (DUN–5563) **Contamination control, Columbia River: Quarterly report, October–December 1968.** Geier, R.G. Douglas United Nuclear, Inc., Richland, WA (United States). 10 Mar 1969. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93000319. Source: OSTI; NTIS (US Sales Only); GPO Dep.

It is the purpose of this report to present data obtained from the routine reactor effluent radioactivity monitoring program as well as the results obtained from the research and development program directed toward the reduction of effluent radioactivity.

285 (INFO–0315) **Plant air quality following accidental radioactive releases: Literature survey and model tests on recirculation and interference for two in-line cubes.** Slawson, P.R. (Envirodyne Limited (Canada)); Hitchman, G.J. Atomic Energy Control Board, Ottawa, ON (Canada). 15 Jul 1987. 50p. Project 2.110.1;Contract DSS 52SS-87035-6-4082. Order Number DE93603679. Source: OSTI; NTIS (US Sales Only); INIS.

Radionuclides exhausted to the atmosphere through vent stacks may contaminate the immediate building structure and/or nearby adjacent buildings resulting in hazardous contaminants entering the intake air. The objective of the work reported here was to obtain an overview of the analytical and experimental tools available to evaluate the transport and diffusion of vented effluents, and the nature of flows about structures, in order to predict the concentrations adjacent to an subsequently inside the immediate and nearby structures. A scaling analysis established the requirements for physical modelling of flows about structures in wind and/or water tunnels. Subsequently, a series of test model studies were conducted in a water tunnel in the Mechanical Engineering Department

of the University of Waterloo. The expected result that increased stack height and structure separation have on reducing recirculation and interference is clearly illustrated. Interference was still significant on the downstream structure when the vent stack height was increased to its maximum of one model cube height above the cube. A literature survey was conducted to establish the nature and mathematical modelling of flows about structures. Also, mathematical modelling of the concentration field from roof-top vent effluents and subsequently the models for predicting concentrations within structures was investigated. No specific data on concentrations within structures were found. There is a strong need for well documented test on the concentration fields about model structures, with which more generic models may be developed. Very little data is available on multiple structures. It is recommended that physical model studies be conducted, that simulate realistic exhaust and intake air vents with measurement of both the inside and the outside concentration fields. (59 refs., 21 figs., 2 tabs.).

286 (INIS-GB–447) **Environmental monitoring programme: Report for 1989 on the environmental impact of authorised discharges of radioactive wastes in England and Wales.** Department of the Environment, London (United Kingdom). Her Majesty's Inspectorate of Pollution. Aug 1991 45p. Order Number DE93605593. Source: OSTI; NTIS (US Sales Only); INIS.

During 1989 there were about 1000 premises in England and Wales authorised to discharge radioactive wastes. The majority of these premises consisted of hospitals, universities and industrial, research or manufacturing centres. Discharges from these premises when made in accordance with the strict conditions specified in their authorisations will have been of little radiological significance. In the case of nuclear sites authorisations or approvals are issued jointly by the DoE and the Ministry of Agriculture, Fisheries and Food (MAFF) known collectively as the Authorising Departments. In Wales these functions are undertaken by the Welsh Office with the support of HMIP and MAFF. The Authorising Departments specify numerical limits on the amounts of radioactivity which operators may discharge to the environment. In addition operators are required to demonstrate that the best practicable means (BPM) to minimise discharges is undertaken. Operators are also required to carry out appropriate environmental monitoring to demonstrate the effectiveness of BPM. As part of their regulatory functions the Authorising Departments undertake their own environmental monitoring programmes to act as both a check on site operator's returns and to provide independent data on the exposure of the public. HM Inspectorate of Pollution has monitored levels of radioactivity in drinking water sources for many years and published results annually. MAFF undertakes two programmes to monitor radioactivity in the aquatic environment and in terrestrial foodstuffs and publishes annual reports. Environmental monitoring programmes undertaken by both nuclear site operators and government departments are summarised. (author).

287 (SKB-TR–91-21) **Aespoe hard rock laboratory. Field investigation methodology and instruments used in the preinvestigation phase, 1986-1990.** Almen, K.E. (Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden)); Zellman, O. Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden). Dec 1991. 150p. Order Number DE93603574. Source: OSTI; NTIS; INIS.

The Aespoe hard rock laboratory project started in 1986. The pre-investigation phase, 1986-1990, involved extensive field measurements from the surface as well as from boreholes, aimed at characterizing the rock formation with regard to geology, geohydrology, hydrochemistry and rock mechanics. The field investigation methodology used in the project was based on experience from and developments during the previous SKB study site investigation programme. However, in some respects the techniques were changed or modified. Major changes have been possible due to a new drilling technique, telescope-type drilling. This report describes the logistics of the investigation programme, characterized to a large extent by multi-purpose planning and performance of the activities in order to optimize the use of available resources; time, personnel and equipment. Preliminary hydraulic testing and groundwater sampling were conducted during the drilling of each borehole. When the drilling was completed an extensive set of singlehole investigations were carried out: geophysical logging, borehole radar, hydraulic tests of different kinds, water sampling and rock stress measurements. Multipackers were installed in the boreholes as soon as possible after the borehole investigations. The system enables monitoring of groundwater pressure, water sampling and groundwater flow measurements to be performed by means of dilution tests and tracer injection. Boreholes with such equipment were used as observation holes during interference pumping tests and long term hydraulic and tracer tests. The monitoring programme will continue during the subsequent phases of construction and operation of the Aespoe hard rock laboratory. (83 refs., 94 figs.) (au).

288 (SKB-TR–92-11) **Numerical groundwater flow calculations at the Finnsjoen study site - The influence of the regional gradient.** Lindbom, B. (Kemakta Consultants Co., Stockholm (Sweden)); Boghammar, A. Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden). Apr 1992. 54p. Order Number DE93603582. Source: OSTI; NTIS; INIS.

The present report describes the modelling efforts of the groundwater flow situation at the Finnsjoen site in northern Uppland, approximately 140 km north of Stockholm. The study forms part of the SKB 91 performance assessment project, and aims at describing the model sensitivity to changes in the prevailing regional gradient, as well as the local, with regard to both direction and magnitude. Particular emphasis has been put into the evaluation of travel times and travel paths form a potential repository, and also on flux values at repository level. The analyses were based on the finite element technique and made use of the NAMMU-code for stationary calculations in three dimensions. The fracture zones within the modelled area were modelled implicitly with an averaging technique. (au).

289 (SKN–59) **Survey of in situ testing at underground laboratories with application to geologic disposal of spent fuel waste in crystalline rock.** Hardin, E. (Reptec Corporation/Swedish Engineering Services (SINTAB), Bromma (Sweden)). National Board for Spent Nuclear Fuel, Stockholm (Sweden). Apr 1992. 205p. Order Number DE93603583. Source: OSTI; NTIS; INIS.

This report is intended for use in designing testing programs, or as backup material for the review of 'R and D 92' which will be the next three-year plan for spent fuel repository siting and characterization activities in Sweden. There are eight major topics, each of which is addressed in a chapter of around 2000 to 10000 words. The major topics are defined to capture the reasons for testing, in a way that limits overlap between chapters. Other goals of this report are to provide current information on recent or ongoing tests in crystalline rock, and to describe insights which are important but not obvious from the literature. No data are presented, but the conclusions of testing programs are summarized. The principal sources were reports (in English) produced by the laboratory projects particularly the Stripa Project (SKB), the Underground Research Laboratory in Canada (AECL), and the Grimsel Test Site in Switzerland (Nagra). Articles from refereed journals have been used in lieu of project literature where possible and appropriate. (au).

290 (SKN–64) **Geological aspects for siting a repository for spent nuclear fuel. Part 2: Geological data on a local level.** Palmqvist, K. (Berggeologiska Undersoekningar AB (BERGAB) (Sweden)). National Board for Spent Nuclear Fuel, Stockholm (Sweden). Jan 1992. 111p. (In Swedish). Order Number DE93603584. Source: OSTI; NTIS; INIS.

The report deals with the methodics and methods used for characterizing the quality of the bedrock connected with underground disposal of radioactive wastes. (32 refs.).

291 (STRIPA-TR–91-17) **Large scale cross hole testing.** Ball, J.K. (Golder Associates, Nottingham (United Kingdom)); Black, J.H.; Doe, T. Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden). May 1991. 125p. Order Number DE93603585. Source: OSTI; NTIS; INIS.

As part of the Site Characterisation and Validation programme the results of the large scale cross hole testing have been used to document hydraulic connections across the SCV block, to test conceptual models of fracture zones and obtain hydrogeological properties of the major hydrogeological features. The SCV block is

highly heterogeneous. This heterogeneity is not smoothed out even over scales of hundreds of meters. Results of the interpretation validate the hypothesis of the major fracture zones, A, B and H; not much evidence of minor fracture zones is found. The uncertainty in the flow path, through the fractured rock, causes sever problems in interpretation. Derived values of hydraulic conductivity were found to be in a narrow range of two to three orders of magnitude. Test design did not allow fracture zones to be tested individually. This could be improved by testing the high hydraulic conductivity regions specifically. The Piezomac and single hole equipment worked well. Few, if any, of the tests ran long enough to approach equilibrium. Many observation boreholes showed no response. This could either be because there is no hydraulic connection, or there is a connection but a response is not seen within the time scale of the pumping test. The fractional dimension analysis yielded credible results, and the sinusoidal testing procedure provided an effective means of identifying the dominant hydraulic connections. (10 refs.) (au).

292 (STRIPA-TR–92-04) **Economical and technical optimization of site investigations - a multivariate approach based on Stripa F1 and F2 borehole information.** Schunnesson, H. (EMX Drilltech AB, Luleaa (Sweden)); Lundholm, I. Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden). Jan 1992. 79p. Order Number DE93603589. Source: OSTI; NTIS; INIS.

In this report multivariate analysis is presented and used as a tool to optimize site investigations. The technique is tested on earlier accumulated data from bore hole F1 and F2 in the Stripa mine, in an attempt to predict the hydraulic conductivity of the rock. Different investigation methods can be selected only on behalf of their correlation to the hydraulic conductivity and accurate predictions can be made with as high resolution as the core mapping data and the data from the geophysical logging allows. In the second part of the report the integration of this technique in the pre-investigation is discussed. The most important steps is to form a site analysis group, responsible for data collection, analysis and investigation, utilize all at the time available data to improve the investigation. This will also lead to a less rigid and more flexible pre-investigation that will improve the quality and reduce time consumption. (12 refs.)(au).

293 (STRIPA-TR–92-14) **Site characterization and validation - inflow to the validation drift.** Harding, W.G.C. (Golder Associates Ltd., Nottingham (United Kingdom)); Black, J.H. Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden). Jan 1992. 105p. Order Number DE93603598. Source: OSTI; NTIS; INIS.

Hydrogeological experiments have had an essential role in the characterization of the drift site on the Stripa project. This report focuses on the methods employed and the results obtained from inflow experiments performed on the excavated drift in stage 5 of the SCV programme. Inflows were collected in sumps on the floor, in plastic sheeting on the upper walls and ceiling, and measured by means of differential humidity of ventilated air at the bulkhead. Detailed evaporation experiments were also undertaken on uncovered areas of the excavated drift. The inflow distribution was determined on the basis of a system of roughly equal sized grid rectangles. The results have highlighted the overriding importance of fractures in the supply of water to the drift site. The validation drift experiment has revealed that in excess of 99% of inflow comes from a 5 m section corresponding to the 'H' zone, and that as much as 57% was observed coming from a single grid square (267). There was considerable heterogeneity even within the 'H' zone, with 38% of such samples areas yielding no flow at all. Model predictions in stage 4 underestimated the very substantial declines in inflow observed in the validation drift when compared to the SDE; this was especially so in the 'good' rock areas. Increased drawdowns in the drift have generated less flow and reduced head responses in nearby boreholes by a similar proportion. This behaviour has been the focus for considerable study in the latter part of the SCV project, and a number of potential processes have been proposed. These include 'transience', stress redistribution resulting from the creation of the drift, chemical precipitation, blast-induced dynamic unloading and related gas intrusion, and degassing. (au).

0540 Health and Safety

Refer also to citation(s) 198, 214, 219, 229, 258, 273, 304, 305, 613, 622, 1726, 1737, 1742, 1758, 1761

294 (ANL/CP–76005) **Evaluation of surface water treatment and discharge options for the Weldon Spring Site Remedial Action Project.** Goyette, M.L.; MacDonell, M.M. Argonne National Lab., IL (United States). [1992]. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-921029–6: Annual Department of Energy model conference on waste management and environmental restoration, Oak Ridge, TN (United States), 19-22 Oct 1992). Order Number DE92041105. Source: OSTI; NTIS; INIS; GPO Dep.

The US Department of Energy (DOE), under its Environmental Restoration and Waste Management Program, is responsible for conducting response actions at the Weldon Spring site in St. Charles County, Missouri. The site consists of two noncontiguous areas: (1) the chemical plant area, which includes four raffinate pits and two small ponds, and (2) a 3.6-ha (9-acre) quarry located about 6.4 km (4 mi) southwest of the chemical plant area. Both of these areas became chemically and radioactively contaminated as a result of processing and disposal activities that took place from the 1940s through 1960s. The Weldon Spring site, located about 48 km (30 mi) west of St. Louis, is listed on the National Priorities List of the US Environmental Protection Agency. Nitroaromatic explosives were processed by the Army at the chemical plant area during the 1940s, and radioactive materials were processed by DOE's predecessor agency (the Atomic Energy Commission) during the 1950s and 1960s. Overall remediation of the Weldon Spring site is being addressed through the Weldon Spring Site Remedial Action Project, and it consists of several components. One component is the management of radioactively and chemically contaminated surface water impoundments at the chemical plant area – i.e., the four raffinate pits, Frog Pond, and Ash Pond which was addressed under a separate action and documented in an engineering evaluation/cost analysis report. This report discusses the evaluation of surface water treatment at the Weldon Spring site.

295 (DOE/NV/10845–14) **Community Radiation Monitoring Program: Annual report, October 1, 1990–September 30, 1991.** Cooper, E.N.; McArthur, R.D. Nevada Univ., Reno, NV (United States). Water Resources Center. Jun 1992. 58p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC08-90NV10845. Order Number DE93000385. Source: OSTI; NTIS; GPO Dep.

Publication No. 45095.

The Community Radiation Monitoring Program is a cooperative effort between the US Department of Energy (DOE), the US Environmental Protection Agency (EPA), the Desert Research Institute (DRI), a division of the University and Community College System of Nevada, and the Nuclear Engineering Laboratory of the University of Utah (U of U). This eleventh year of the program began in the summer of 1991 and the work continues as an integral part of the DOE-sponsored long-term offsite radiological monitoring effort that has been conducted by EPA and its predecessors since the inception of nuclear testing at the Nevada Test Site (NTS). The primary objectives of this program are still to increase the understanding by the people who live in the area surrounding the NTS of the activities for which the DOE is responsible, to enhance the performance of radiological sampling and monitoring, and to inform all concerned of the results of those efforts. One of the primary methods used to improve the communication link with the potentially impacted area has been the hiring and training of local citizens as Managers and program representatives in 19 communities adjacent to and downwind from the NTS. These Managers, active science teachers wherever possible, have succeeded, through their training, experience, community standing, and effort, in becoming a very visible, able and valuable asset in this link.

296 (DOE/OR–1060-D1) **Remedial Investigation work plan for Bear Creek Valley Operable Unit 2 (Rust Spoil Area, SY-200 Yard, Spoil Area 1) at the Oak Ridge Y-12 Plant, Oak Ridge, Tennessee.** Oak Ridge Y-12 Plant, TN (United States); Science Applications International Corp., Oak Ridge, TN (United States). Sep 1992. 397p. Sponsored by USDOE, Washington, DC

(United States). DOE Contract AC05-84OS21400. (ES/ER–43-D1;Y/ER/Sub–91-99069/1). Order Number DE92041220. Source: OSTI; NTIS; INIS; GPO Dep.

This Remedial Investigation (RI) work plan contains summaries of geographical, historical, operational, geological, and hydrological information specific to the unit. The potential for release of contamination to receptors through the various media is addressed, and a sampling and analysis plan is presented to determine the extent of release of contamination to the surrounding environment. Proposed activities include walkover radiation surveys at all sites, soil borings at SY-200, piezometer installation and water table sampling at SA-1 and SY-200, and surface water and sediment runoff sampling at all three sites. Data from the site characterization activities will be combined with data from ongoing site-wide monitoring programs (i.e., groundwater, surface water, and biological monitoring) to provide input for a screening-level risk assessment and evaluation of alternative remedial actions.

297 (DOE/OR/21949–341) **Colonie Interim Storage Site annual environmental report for calendar year 1991, Colonie, New York: Formerly Utilized Sites Remedial Action Program (FUSRAP).** Bechtel National, Inc., Oak Ridge, TN (United States). Sep 1992. 179p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-91OR21949. Order Number DE93001267. Source: OSTI; NTIS; INIS; GPO Dep.

This document describes the environmental monitoring program at the Colonie Interim Storage Site (CISS) and surrounding area, implementation of the program, and monitoring results for 1991. Environmental monitoring at CISS began in 1984 when Congress added the site to the US Department of Energy's Formerly Utilized Sites Remedial Action Program. CISS property and surrounding areas were radioactively contaminated by operations conducted by National Lead Industries, which manufactured various components from uranium and thorium from 1958 to 1984. The environmental monitoring program at CISS includes sampling networks for external gamma radiation exposure and for radium-226, thorium-232, and total uranium concentrations in surface water, sediment, and groundwater. Additionally, several nonradiological parameters are measured in groundwater. In 1992 the program will also include sampling networks for radioactive and chemical contaminants in stormwater to meet permit application requirements under the Clean Water Act. Monitoring results are compared with applicable Environmental Protection Agency (EPA) standards, DOE derived concentration guides (DCGs), dose limits, and other requirements in DOE.orders. Environmental standards are established to protect public health and the environment. Results of environmental monitoring during 1991 indicate that average concentrations of radioactive contaminants of concern were well below applicable standards and DCGS. Concentrations of some chemical contaminants in groundwater were above-the New York State Department of Environmental Conservation (Class GA) and EPA guidelines for drinking water. The potential annual radiation exposure (excluding background) calculated for a hypothetical maximally exposed individual is 0.23 mrem (milliroentgen equivalent man), which is less than an individual would receive while traveling in an airplane at 12,000 meters (39,000 feet) for one hour.

298 (ES/CSET–3/R1) **Logic Model Application Guide: Safety Analysis Report Update Program: Revision 1.** Martin Marietta Energy Systems, Inc., Oak Ridge, TN (United States). Jul 1992. 63p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92040754. Source: OSTI; NTIS; GPO Dep.

The purpose of the Safety Analysis Report (SAR) Update Program is to update safety documentation for all facilities, both nuclear and non-nuclear, operated by Martin Marietta Energy Systems, Inc. Significant hazards and the risk associated with those hazards will be identified by updating the safety documentation. The extensive involvement of operations personnel in the SAR Update Program has already served to enhance both the safety culture and the safe operation of facilities and will continue with the FSETs' participation in the logic model development process. Phase I hazard screening involved all facilities operated by Energy Systems. However, the second part of the Phase I task involves only those facilities classified as either moderate or high hazard in the hazard screening process or specified by the Plant Safety Evaluation Team (PSET). For the moderate or high hazard facilities, additional qualitative logic models will be developed both to identify the causes of specific accidents and to evaluate the possible consequences associated with particular accidents. The purpose of this document is to provide specific guidance on the preparation of the appropriate logic models for use in Phase I of the SAR Update Program. The Logic Model Application Guide (LMAG) will implement and expand on the guidance expressed in ES/CSET-I/R2, particularly Sections 3.6 and 3.7. The methods described in this guide may also be applicable to safety analysis tasks not associated with the SAR update program.

299 (ES/CSET–15) **Safety classification and special design criteria development application guide: Safety Analysis Report Update Program.** Oak Ridge National Lab., TN (United States). Aug 1992. 43p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92040753. Source: OSTI; NTIS; GPO Dep.

This document is a pilot application guide to the identification of Safety class Items (SCIs) and the development of associated special design criteria. It is intended to interpret, apply, and supplement, where necessary, DOE orders and guidance to make a practical, coherent, risk-based framework for the safety analyst to use identifying SCIs in conjunction with Facility Safety Evaluation Teams (FSETs) for existing facilities and design teams for new and modified facilities. Three categories of Safety Class Items are identified in this guide: SC-1, SC-2, and SC-3. SC-1 items are required primarily to protect the health and safety of the off-site public, SC-2 items are required solely to protect the health and safety of on-site personnel, and SC-3 items are required solely to protect the health and safety of the facility operators. These definitions are taken from DOE/OR-901, Guidance for Preparation of Safety Analysis Reports (ref. 3), Appendix C, "Guidelines for Determination of Safety Class Items."

300 (SAND–92-0684C) **Advanced handling concepts and application to storage and transport systems.** Bennett, P.C.; Sanders, T.L. Sandia National Labs., Albuquerque, NM (United States). [1992]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-9207102–66: Institute of Nuclear Materials Management (INMM) annual meeting, Orlando, FL (United States), 19-22 Jul 1992). Order Number DE92040264. Source: OSTI; NTIS; INIS; GPO Dep.

The application of robotics to the handling of spent fuel casks at a receiving facility such as an MRS is a practical solution to meeting both operator dose limitations and DOE facility design goals. Simple cost/dose trade-off analysis based on International Commission on Radiological Protection (ICRP) methods indicates operator dose can be substantially reduced at potential cost savings by automating the major dose-producing operations. Reliability of robotic systems need not be high to substantially lower handling costs and operator dose. The feasibility of automating many receiving operations has been demonstrated in the laboratory. Demonstrations include visual cask inspection, radiation survey, impact limiter removal, transporter tiedown release and manipulation, cask uprighting and transport, and cask head preparation; including leak testing, gas purging, and lid closure and seal removal.

301 (WSRC-MS–92-278) **Lessons learned from hazardous waste remediation.** Leibfarth, E.C. Westinghouse Savannah River Co., Aiken, SC (United States). [1992]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. (CONF-9209141–2: 19. annual American Society for Quality Control (ASQC) National Energy Division conference, Orlando, FL (United States), 20-23 Sep 1992). Order Number DE93000708. Source: OSTI; NTIS; GPO Dep.

In the nine-year history of hazardous waste remediation at the Savannah River Site, many techniques have been employed. Since the activities and the technology applied to these activities were new to the Site, many of the techniques employed were new and innovative, and the Site has developed hands on remediation experience. This presentation reviews lessons learned during hazardous waste remediation activities at the Site.

0550 Safeguards, Inspection, and Accountability

Refer also to citation(s) 2479

302 (IAEA-INFCIRC–409) **Agreement of 3 August 1992 between the Government of the Republic of Malawi and the International Atomic Energy Agency for the application of safeguards in connection with the Treaty on the Non-Proliferation of Nuclear Weapons.** International Atomic Energy Agency, Vienna (Austria). Sep 1992. 35p. Order Number DE93604048. Source: OSTI; NTIS (US Sales Only); INIS.

Hard copies are available in English, French, Russian and Spanish from IAEA Div. of Publications, Distribution Unit.

The document contains two parts. The first one stipulates the agreement of Malawi to accept safeguards on all source or special fissionable material in all peaceful nuclear activities within its territory, under its jurisdiction or carried out under its control anywhere, for the exclusive purpose of verifying that such material is not diverted to nuclear weapons or other nuclear explosive devices. The second part specifies the procedures to be applied in the implementation of the safeguards provisions of Part I.

303 (KAERI/RR–1095/91) **Technology development for nuclear material accountability.** Hong, Jong Sook (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Lee, Byung Doo; Cha, Hong Ryul; Choi, Hyoung Nae; Na, Won Woo; Park, Ho Joon; Kim, Eun Ka; Lee, Young Gil; Chun, Yong Bum. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Feb 1992. 225p. (In Korean). Order Number DE93606010. Source: OSTI; NTIS (US Sales Only); INIS.

A positive on-site verification technique of spent PWR fuel rods in pool at PIEF and a program for MUF evaluation in bulk material handling facility were developed in support of facility operation and IAEA verification activity. When spent fuel was measured by gamma-ray spectrometry the measured intensity of Cs-137 662 KeV gamma-ray from the sample was clearly identified against comparing background. By the MCNP code simulations, the flux of 662 KeV gamma-ray in the collimated rod was also different from that from the adjacent one. Base on this fact it is possible to identify spent fuel without having a rod pulled out of assembly in spent pond. This method may be useful as a spent fuel verification tool for both IAEA and facility operator. It may also contribute to the reduction of manpower and operational time. A system for facility MUF evaluation was established to apply it to the bulk material handling facility. With required input data the evaluation program was run to produce final results for evaluation of the soundness of MUF. This program was tested with real input data from CANDU fuel fabrication facility in KAERI. The outcome showed that sigma MUF was not significant to sigma international but MUF was found to be statistically significant as compared to critical value at 95% confidence interval. (Author).

304 (LA–12387-M) **Nuclear criticality safety: 3-day training course.** Schlesser, J.A. (ed.). Los Alamos National Lab., NM (United States). Nov 1992. 147p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE93002849. Source: OSTI; NTIS; GPO Dep.

This compilation of notes is presented as a source reference for the criticality safety course. It represents the contributions of many people, particularly Tom McLaughlin, the course's primary instructor. At the completion of this training course, the attendee will: (1) be able to define terms commonly used in nuclear criticality safety; (2) be able to appreciate the fundamentals of nuclear criticality safety; (3) be able to identify factors which affect nuclear criticality safety; (4) be able to identify examples of criticality controls as used at Los Alamos; (5) be able to identify examples of circumstances present during criticality accidents; (6) be able to identify examples of safety consciousness required in nuclear criticality safety.

305 (LA–12388-M) **Nuclear criticality safety: 5-day training course.** Schlesser, J.A. (ed.). Los Alamos National Lab., NM (United States). Nov 1992. 159p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE93002308. Source: OSTI; NTIS; GPO Dep.

This compilation of notes is presented as a source reference for the criticality safety course. It represents the contributions of many people, particularly Tom McLaughlin, the course's primary instructor. At the completion of this training course, the attendee will: be able to define terms commonly used in nuclear criticality safety; be able to appreciate the fundamentals of nuclear criticality safety; be able to identify factors which affect nuclear criticality safety; be able to identify examples of criticality controls as used at Los Alamos; be able to identify examples of circumstances present during criticality accidents; be able to identify examples of computer codes used by the nuclear criticality safety specialist; be able to identify examples of safety consciousness required in nuclear criticality safety.

0560 Legislation and Regulations

Refer also to citation(s) 213, 214

07 ISOTOPE AND RADIATION SOURCE TECHNOLOGY

Refer also to citation(s) 2433

0701 Physical Isotope Separation

Refer also to citation(s) 2429

306 (BNL–47949) **Production of gallium-66, a positron emitting nuclide for radioimmunotherapy.** Mirzadeh, S. (Oak Ridge National Lab., TN (United States)); Chu, Y.Y. Brookhaven National Lab., Upton, NY (United States). [1991]. 2p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016 ;AC05-84OR21400. (CONF-910503–25: International conference on nuclear data for science and technology, Juelich (Germany), 13-17 May 1991). Order Number DE93000377. Source: OSTI; NTIS; GPO Dep.

Excitation functions for production of ^{66}Ga via α-induced nuclear reactions on enriched ^{66}Zn and ^{64}Zn have been measured with $E_\alpha \leq 27.3$ MeV and $E_\alpha \leq 43.7$ MeV employing the stack-thin target technique. In addition, the induced activity of ^{67} Ga in the same sets of targets allowed an evaluation of the excitation functions of the corresponding nuclear reactions.

307 (CONF-920933–1) **Stable isotope enrichment: Current and future potential.** Tracy, J.G.; Aaron, W.S. Oak Ridge National Lab., TN (United States). [1992]. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 16. world conference of the International Nuclear Target Development Society: nuclear target preparation; Legnaro (Italy); 21-25 Sep 1992. Order Number DE92041258. Source: OSTI; NTIS; INIS; GPO Dep.

Oak Ridge National Laboratory (ORNL) operates the Isotope Enrichment Facility for the purpose of providing enriched stable isotopes, selected radioactive isotopes (including the actinides), and isotope-related materials and services for use in various research applications. ORNL is responsible for isotope enrichment and the distribution of approximately 225 nongaseous stable isotopes from 50 multi-isotopic elements. Many enriched isotope products are of prime importance in the fabrication of nuclear targets and the subsequent production of special radionuclides. State-of-the-art techniques to achieve special isotopic, chemical, and physical requirements are performed at ORNL This report describes the status and capabilities of the Isotope Enrichment Facility and the Isotope Research Materials Laboratory as well as emphasizing potential advancements in enrichment capabilities.

308 (KAERI/RR–996/90) **The development of cyclotron radionuclides(II).** Lee, Jong Min (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Chun, Kwon Soo; Yang, Seong Dae. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Jul 1991. 123p. (In Korean). Order Number DE93605223. Source: OSTI; NTIS (US Sales Only); INIS.

In this project, the production method of Ga-67 for the diagnosis of malignant tumor using enriched Zn-68, Rb-81 for the lung study and Mn-54 used as standard source were studied. And the quality control methods of Co-55 and Na-22 were established and production method of Tl-201 using enriched material was reviewed. The

target for the mass production of Ga-67 using Zn-68 enriched material was prepared by electroplating. The chemical processing and quality control of Ga-67 and recovery of Zn-68 were established. For the development of Rb-81 → Kr-81m generator, the remotely controlled gas target and chemical processing system were designed. Carrier free Mn-54 was produced via $^{54}Cr(p,n)$ and $^{59}Co(p,\alpha n)$ nuclear reactions and separated by ion-exchange chromatography. The production rates were 4.5μCi/μAh and 11.85μCi/μAh respectively. The measurement of excitation function was carried out for the $^{59}Co(p,\alpha pn)$ ^{54}Mn nuclear reaction in the energy range 50.5→0 MeV. Then the maximum cross section was 47.48mb at 41.2MeV and the threshold energy was 27.3MeV. (Author).

0702 Radiation Sources

Refer also to citation(s) 1030, 1263, 1348, 1397, 1737, 2088

309 (AECL–10032) **Sensitivity analysis of a reaction model for the radiation treatment of combustion gases.** Dickson, L.W. (Atomic Energy of Canada Ltd., Chalk River, ON (Canada). Chalk River Nuclear Labs.); Paquette, J.; Busi, F.; D'Angelantonio, M. Atomic Energy of Canada Ltd., Pinawa, MB (Canada). Whiteshell Nuclear Research Establishment. Jul 1991. 32p. Order Number DE93603765. Source: OSTI; NTIS (US Sales Only); INIS.

Sensitivity analyses were performed on chemical mechanisms for the treatment of combustion flue gases with high-energy radiation. The sensitivity analysis of the radical production reactions showed that the radical concentrations did not depend strongly on most of the ion-molecule reaction rates. A simplified radical production model was developed based on this result. Sensitivity analyses performed on the NO_x and NO_x/SO_2 removal mechanisms showed that most of the radical-radical reactions could be removed from these mechanisms without affecting the predicted major species concentrations. The sensitivity analysis results provided a useful guide for model reduction, but some chemical knowledge was also required to interpret the implications of the sensitivity analysis correctly. (7 tabs., 3 figs., 39 refs.).

310 (ANL/CP–76009) **Diffusion-induced grain boundary migration during ion beam mixing of Au/Cu bilayers.** Alexander, D.E.; Baldo, P.M.; Rehn, L.E. Argonne National Lab., IL (United States). Sep 1992. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9209200–4: 8. international conference on ion beam modification of materials, Heidelberg (Germany), 7-11 Sep 1992). Order Number DE93000508. Source: OSTI; NTIS; INIS; GPO Dep.

Experiments were performed to evaluate the effect of 1.5 MeV Kr irradiation on diffusion-induced grain boundary migration (DIGM) in Au/Cu bilayers in the temperature range of $300 \leq T \leq 050$K. The experimental results were consistent with DIGM occurring in bilayers both during irradiation and during annealing treatments. Rutherford backscattering spectrometry showed a nearly uniform distribution of Cu present through the entire thickness of appropriately prepared polycrystalline Au films irradiated or annealed at temperatures $\geq$400K. No parallel effect was seen in similarly treated single-crystal films. In each polycrystalline sample studied, irradiation resulted in greater amounts of Cu present uniformly in the Au compared to annealing-only. The magnitudes of measured Cu compositions were substantially greater than that expected solely from grain boundary diffusion. A simple analysis of the process indicated that ion irradiation affects DIGM by increasing the composition of Cu present in alloyed zones and/or by increasing the grain boundary velocity in the Au.

311 (BNL–47801) **Position and wavelength stability of the X25 doubly-focussed monochromatic beam.** Berman, L. Brookhaven National Lab., Upton, NY (United States). Jul 1992. 38p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. Order Number DE92041277. Source: OSTI; NTIS; INIS; GPO Dep.

One of the primary requirements of x-ray scattering experiments is stability of the incident beam, in position and wavelength. If this requirement is met, variations in the incident monochromatic beam intensity, resulting, for instance, from the changing current in the storage ring, can be properly normalized using an incident beam intensity monitor. If the incident beam's position or wavelength varies, however, then normalizing to an incident intensity monitor becomes less reliable, because the monitor, scattering sample, and downstream detector can have different response sensitivities to position and wavelength. The problem gets worse if the incident beam is contaminated with harmonics, for the harmonic profile usually differs substantially from the fundamental profile. Beam line optics are often misaligned intentionally to reduce harmonic contamination to avoid, e.g., detector saturation, yet position and wavelength instabilities can give rise to a time-varying harmonic content in the incident beam. This report summarizes measurements of the position and wavelength stabilities of the X25 doubly-focussed monochromatic beam, performed at 8 key using Si(III) monochromator crystals. Plans and suggestions for improving these are also discussed.

312 (EGG–10617-3012) **The Sealed Tube Neutron Generator.** Tunnell, L.N.; Beyerle, A.; Durkee, R.; Headley, G.; Hurley, P. EG and G Energy Measurements, Inc., Santa Barbara, CA (United States). Special Technologies Lab. [1992]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC08-88NV10617. (CONF-921116–1: 12. international conference on the application of accelerators in research and industry, Denton, TX (United States), 2-5 Nov 1992). Order Number DE93000691. Source: OSTI; NTIS; INIS; GPO Dep.

A Sealed Tube Neutron Generator (STNG) has been designed and tested at Special Technologies Laboratories (STL) in Santa Barbara, California. Unlike similar tubes that have been used for years in other applications, e.g., by the oil well logging industry, the present device was designed primarily to be part of the Associated Particle Imaging (API) system. Consequently, the size and quality of the neutron spot produced by the STNG is of primary importance. Results from initial measurements indicate that performance goals are satisfied.

313 (EUR–13647/III, pp. 993-1012) **Quantitative analysis and automation of CaF_2 ore flotation via neutronic activation.** Reggiani, F. (Bologna Univ. (Italy)); Garagnani, A.; Lembo, L.; Muntoni, C. Commission of the European Communities, Luxembourg (Luxembourg). 1992. Contract MA 1M-0061-C. In *Summary reports of the R and D programme: primary raw materials (1986-89) - Volume III.* 1046p. Order Number DE93720867. Source: OSTI; NTIS (US Sales Only); INIS.

The aim of the project was to prove the operative feasibility of an 'one line analysis' based on nuclear activation using 14 MeV neutrons. This on line analysis method was to be used to automate control of the flotation process for ores containing mostly fluorspar. The thermoluminescence technique was also forecast as a subsidiary method in those points of the flotation cycle where less precision is acceptable. (author). 11 figs., 4 tabs.

314 (EUR–13647/III, pp. 1013-1030) **On-line analysis of cement raw materials by prompt gamma neutron activation analysis.** Pinault, J.L. (Bureau de Recherches Geologiques et Minieres (BRGM), 45 - Orleans (France)). Commission of the European Communities, Luxembourg (Luxembourg). 1992. Contract MA1M-0066. In *Summary reports of the R and D programme: primary raw materials (1986-89) - Volume III.* 1046p. Order Number DE93720867. Source: OSTI; NTIS (US Sales Only); INIS.

This paper presents raw materials on-line analysis by prompt gamma neutron activation analysis. Two types of products are analysed: a coarse, pre-crushed material on a belt-conveyor, and a fine material before its introduction into the kiln (the meal flows around the detector). (A.B.).

315 (EUR–14363, pp. 149-164) **Dismantling of cells 22, 23 and 24 for the fabrication of caesium and strontium sources at CE Saclay ORIS pilot facility.** Maurel, J.J. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Direction du Cycle du Combustible); Garcia, A.; Moreau, J.C. Commission of the European Communities, Luxembourg (Luxembourg). 1992. (CONF-9109441–: 2. Seminar on practical decommissioning experience with nuclear installations in the European Community,

Sellafield (United Kingdom), 25-26 Sep 1991). In *Practical decommissioning experience with nuclear installations in the European Community*. 207p. Order Number DE93721081. Source: OSTI; NTIS (US Sales Only); INIS.

The cleaning an dismantling of the three hot cells in ORIS Industrie building are not very heavy operation. The surface of the work is reduced; so it is just possible to have only four or five operators at the same time. It is the reason for a long operation delay. The main technical difficulty of these operations consists in: - very high level of radioactivity measured on same apparatus (7000 rad on a press). They must be evacuated without disturbing the industrial production of ORIS Industrie. - putting of working area and the identification of relations between the different intervening parties.

316 (INIS-BR–2937) **Use of x-ray and fluoroscopy assays in the industry of armament and ammunition.** Bohnsack, G. (Philips GmbH, Hamburg (Germany). Supply Center Industrial X-Ray); Schmidt, R. Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). 1989 16p. (In Portuguese). (CONF-8911264–: 9. Brazilian seminar of non destructive testing, Sao Paulo (Brazil), 5-8 Nov 1989). Order Number DE93603763. Source: OSTI; NTIS (US Sales Only); INIS.

The use of X-ray techniques for testing armament materials such as grenades and fuses is presented. (M.C.K.).

0705 Health and Safety

Refer also to citation(s) 1760

08 HYDROGEN

0802 Storage, Transport, and Handling

317 (NEI-FI–168, pp. 115) **Hydrogen and renewable energy sources.** Taehtinen, S. (Technical Research Centre of Finland, Espoo (Finland). Metals Lab.); Tonteri, H. Finnish Wind Power Association, Espoo (Finland). 1990. (CONF-9010521–: FINNWIND'90: conference on wind power in Finland, Pori (Finland), 19-20 Oct 1990). In *Finnwind'90: Presentations*. 120p. Order Number DE93721624. Source: OSTI; NTIS.

Short communication. HYDROGEN FUELS/energy storage; HYDROGEN; ENERGY STORAGE SYSTEMS; PLANNING

09 BIOMASS FUELS

0907 Resources

318 (DOE/ER/13377–5) **Genomic variation in maize: Progress report, 1990.** Rivin, C.J. Oregon State Univ., Corvallis, OR (United States). [1990]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG06-85ER13377. Order Number DE92040971. Source: OSTI; NTIS; GPO Dep.

We have endeavored to learn to learn how different DNA sequences and sequence arrangements contribute to genome plasticity in maize. We describe quantitative variation among maize inbred lines for tandemly arrayed and dispersed repeated DNA sequences and gene families, and qualitative variation for sequences homologous to the Mutator family of transposons. The potential of these sequences to undergo unequal crossing over, non-allelic (ectopic) recombination and transposition makes them a source of genome instability. We have found examples of rapid genomic change involving these sequences in F1 hybrids, tissue culture cells and regenerated plants.

319 (NEI-DK–991) **Energy forests - cultivation and working economy.** Skovbrugsserien, 3-1992. Kelkjaer, J. Landbrugsministeriet, Copenhagen (Denmark). Forskningscentret for Skov og Landskab. 1992. 140p. (In Danish). Contract ENS-1383/89-6. Order Number DE93721416. Source: OSTI; NTIS.

EFP-89.

The aim when cultivating energy forests is to maximize the biomass production through intensive cultivation of tree species with a fast juvenile growth. A suitably short cutting cycle can be used to avoid juvenile growth being replaced by slower growth. The ability to coppice shoots is essential in order to avoid costs of new eatablishment after each harvest. Short rotation forestry is a type of cultivation which depends on the fast juvenile growth of a few broad-leaved species and their ability for cutting reproduction and formation of stump shoots. Through intensive cultivation, these characteristics are exploited with the aim of producing biomass which is used for the production of energy. Prior to stand establishment the soil must be thoroughly cultivated and weed control is essential. A cutting cycle of 3-5 years and a plant intensity of 18.000 per two and a half acres is appropriate. Fertilization is necessary. Watering is necessary in dryer periods. Fungus disease, insect and mammal attacks etc. are more likely in these large monoclonal and homogenous production units, and must be controlled. The mean level of biomass production in Denmark can reach 8-10 tons of dry matter per 2 1/2 acres p.a. Analysis shows that production is profitable at an estimated interest rate of 3% if the energy forests are run in 4 or 5 cutting cycles and long life spans and if irrigation is unnecessary, yet profitability is estimated to be moderate. Methods of reducing production costs are suggested. (AB) (112 refs.).

320 (NEI-DK–992) **Dry matter production in Danish willow cultivations: Years of growth 1989-1991.** Skovbrugsserien, 4-1992. Kelkjaer, J.; Heding, N. Landbrugsministeriet, Copenhagen (Denmark). Forskningscentret for Skov og Landskab. 1992. 29p. (In Danish). Contract ENS-1383/89-6. Order Number DE93721415. Source: OSTI; NTIS.

EFP-89.

Climatic data, measurements from the growth year 1991, and an analysis and summary of production results from the growth years 1989-1991 are given. The above-ground leafless dry matter production as well as quality and quantity of contributing factors have been registered on 12 production sites distributed over five localities in Denmark. These sites are grown intensively and are representative for the predominating soil and climate conditions in that county. The mean production level of the period is 6-8 tons dry matter per two and a half acres per year. There is considerable variation between the examined localities and from one growth year to another. It is reckoned that the recorded decrease in production in the 1991 growth year is caused by the fact that there was less annual rainfall than usual. The Danish Forest and Landscape Research Institute finds it likely that production potential is higher than the registered mean level of 6-8 tons per 2 1/2 acres p.a.. It is felt that levels can reach 8-10 tons. Utilized measurement methods were the "Mean stool", and "Harvesting" methods and "Plot harvests". The latter method is rather labour intensive and destructive for the production site. Uncertainties related to these methods are insignificant. (AB).

0908 Production

Refer also to citation(s) 319, 320, 1626

321 (DOE/ER–0562P) **Annual report and summaries of FY 1992 activities: Division of Energy Biosciences.** USDOE Office of Energy Research, Washington, DC (United States). Energy Biosciences Div. Sep 1992. 142p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93001757. Source: OSTI; NTIS; GPO Dep.

The Energy Biosciences (EB) program addresses fundamental biological mechanisms in plants and microorganisms not studied in the health field. The mission is to build foundations of knowledge in order to provide bases for new and improved biotechnologies that relate to energy matters. One of the major objectives of the EB program is to probe the enormous capabilities of these organism s to carry out biochemical conversions. For centuries, cultures around the world have depended on plants and microbes for their food, fiber, medicine, fuel, plus a wide variety of other uses. But the earlier usages were the result of empirical findings without the benefit of the powerful research approaches now becoming available. Approaches such as molecular biology, analytical chemistry, computational analysis and others have opened entirely new horizons and opportunities. The limitations are functions of the

commitments being made in generating and merging the new knowledge to realize entirely new products and processes via biotechnology. One of the crucial ingredients to this effort is the study of the basic biology of organisms. The EB program is aimed at generating a sufficient breadth of understanding of basic biological mechanisms so that principles of organisms' growth, survival, maintenance, morphological and biochemical characteristics, and energy utilization will be understood. Ultimately, such knowledge will underpin new biotechnologies. This information is crucial to assure that the technologies that emerge not only serve the needs of society, but do so without unexpected risks to both the health of people and the environment in which they live.

322 (DOE/ER/13739–1) **Molecular studies of functional aspects of plant mitochondria: Progress report.** Siedow, J.N. Duke Univ., Durham, NC (United States). Dept. of Botany. 3 Mar 1992. 37p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-87ER13739. Order Number DE93000676. Source: OSTI; NTIS; GPO Dep.

The goal of this research is to characterize the mechanism by which a protein encoded by mitochondrial genome of cms-T maize (URF13) interacts with a family of the compounds produced by certain fungi (T-toxins) to permeabilize biological membranes. The research carried out during the current funding period has focused on the structure of URF13, and the results support the validity of the three-helix model of URF13 and provide direct evidence for the oligomeric nature of at least some of the URF13 molecules in the membrane. In addition, the toxin binding studies have provided insight into the dynamic nature of the T-toxin:URF13 interaction and the extent to which Asp-39 is crucial to the interaction that leads to membrane pore formation. Additional knowledge of the structure of URF13 is needed if the nature of the interaction between URF13 and T-toxin to produce a hydrophilic pore within the membrane is to ultimately be understood.

323 (NEI-DK–957, pp. 1-10) **Source separation and collection system for biological waste collected from households.** Andresen, S. (A/S Marius Pedersen, Ingenioer og entreprenoerfirma (DK)); Rasmussen, K. Dansk Komite for Affald (DAKOFA), Copenhagen (Denmark). 1992. 278p. (CONF-9206295–: 1. International conference and exhibition on biological waste treatment, Herning (Denmark), 1-4 Jun 1992). In *Biowaste'92: Proceedings.* Order Number DE93721513. Source: OSTI; NTIS.

Sponsored by: ISWA and IAWPRC.

The Government action programme for household waste is to increase the recycling up to 40-50% in the course of the 90'ies. This implies, however, that the organic waste forms part of the recycling and is to be composted in a low or high technology plant, or treated in a biogas system. As a natural consequence hereof comes the development of collection systems to secure a high degree of recycling and at the same time to consider the working environment circumstances when collecting the organic waste. Furthermore cost reducing collection systems will be of great importance when the municipalities decide on a new refuse system. (au).

324 (NEI-DK–962) **Handling comminuted straw: A preliminary study.** Astrupgaard, N.P. DK-Teknik, Soeborg (Denmark). Jul 1992 72p. (In Danish). Contract ENS-51161-91.0057;Contract ENS-51161-91.0078. Order Number DE93721422. Source: OSTI; NTIS.

The handling of comminuted straw out in the fields is investigated partly to determine whether it is possible to store sliced straw under the open sky and partly to document relevant economical aspects. Time was also taken on the slicing of the straw in relation to a JF 3500 and a Taarup 1030 cutting machine. The cost was 0,05 DKK per kilo in the field with the best machine. The cost of transport per kilometer from field to middle storage facility and loading for storage was under 0,10 kr/kg, which is half the price in the case of bales. Alternative modes of transport were significantly more expensive as it took a long time to load. Three stacks of sliced straw with varying moisture content were examined, moisture contents were 10% rising to 15% after 4 months, and 32% and 20% with no change by December. Storage in facilities with domed tops cost 5 1/2 oere/kg. The overall price of handling sliced straw was shown to be half of that for handling straw in bales, this does not include transport. It is suggested that transport costs would be about the same as is the case for bales, possibly 50% higher. A tabel of specified costs in relation to the handling of straw is presented. (AB).

325 (NEI-DK–990) **Sludge and sewage fertilization in forests and energy plantations.** Skovbrugsserien, 2-1992. Hauge Nielsen, K. Landbrugsministeriet, Copenhagen (Denmark). Forskningscentret for Skov og Landskab. 1992. 50p. (In Danish). Order Number DE93721417. Source: OSTI; NTIS.

The use of municipal sewage sludge and other organic wastes as fertilizers has major drawbacks due to their content of pathogens and heavy metals. An enhanced use of organic waste as a fertilizer in non-food crops of little recreational value offers a solution. The growing of hardwoods in short rotation intensive culture (SRIC) for energy purposes is discussed. The net nutrient demand in forest stands is normally small as the amount of nutrients removed following silvicultural practices is small. In the process of harvesting of such stands, substantial amounts of nutrients can be removed. In such instances the application of organic waste can be of great growth enhancing value. A long-term problem is posed by the heavy metal content of the organic wastes. Most heavy metals are released very slowly to the soil solution so that plant uptake is generally small. When growing SRIC, large amounts of nutrients are removed with the crop and organic wastes can be applied regularly. High dry matter increments might be a result of such fertilization. Burning the wood crops for energy is best undertaken in larger boilers where combustion can be controlled. 15-20% of the nitrogen content is converted into NO_x, which return to the surroundings as nitrate. The main part of the remainder is converted to dinitrogen gas and is thus taken out of the ecosystem. The heavy metal content in the ash may be too large for potential use of this ash for fertilization purposes. (AB) (77 refs.).

0909 Processing

Refer also to citation(s) 321, 932, 933

326 (BNL–47946) **Rates of reaction and process design data for the Hydrocarb Process.** Steinberg, M. (Brookhaven National Lab., Upton, NY (United States)); Kobayashi, Atsushi; Tung, Yuanki. Brookhaven National Lab., Upton, NY (United States). Aug 1992. 90p. Sponsored by USDOE, Washington, DC (United States); Environmental Protection Agency, Washington, DC (United States). DOE Contract AC02-76CH00016. Order Number DE93001438. Source: OSTI; NTIS; INIS; GPO Dep.

In support of studies for developing the coprocessing of fossil fuels with biomass by the Hydrocarb Process, experimental and process design data are reported. The experimental work includes the hydropryolysis of biomass and the thermal decomposition of methane in a tubular reactor. The rates of reaction and conversion were obtained at temperature and pressure conditions pertaining to a Hydrocarb Process design. A Process Simulation Computer Model was used to design the process and obtain complete energy and mass balances. Multiple feedstocks including biomass with natural gas and biomass with coal were evaluated. Additional feedstocks including green waste, sewage sludge and digester gas were also evaluated for a pilot plant unit.

327 (DOE/ER/13498–T3) **Molecular biology and genetics of the acetate-utilizing methanogenic bacteria: Progress report, [July 1, 1988–June 30, 1991].** Gunsalus, R.P. California Univ., Los Angeles, CA (United States). Dept. of Microbiology. [1991]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG03-86ER13498. Order Number DE93000780. Source: OSTI; NTIS; GPO Dep.

Acetate conversion to methane and $C0_2$ by the methanogenic archaebacteria is a primary rate limiting step in anaerobic biodegradative processes in nature. However, the genetic study of these organisms has not been experimentally tractable due to the inability to grow and plate the organisms as single cells, and to extract high molecular weight DNA and RNA without shearing. The acetate-utilizing species, Methanosarcina thermolphila TM-1, is being used for the proposed genetic and molecular studies because, unlike previously described acetotrophic methanosarcina that have a thick heteropolysaccharide cell wall, this species can be cultured

in a unicellular form that has a protein cell wall lacking the heteropolysaccharide layer. These cells can be gently disrupted to obtain protoplasts or lysed to yield intact genomic DNA and RNA. Experiments are in progress to develop a gene transfer system in this bacterial species. Methods are being developed and refined for the efficient plating of M. thermophila on defined media, for chemical mutagenesis, and for the isolation of mutants defective in acetate utilization. Chromosomal DNA libraries have been constructed from M. thermophila and are being used to clone genes involved in the acetate utilization pathway (e.g. carbon monoxide dehydrogenase). Once cloned, analysis of the molecular mechanisms responsible for their regulatory control will be performed. These studies should aid our understanding of the pathway for acetate utilization in M. thermophila and serve as a model for elucidating regulatory mechanisms in the acetotrophic methanogens.

328 (DOE/ER/14011–2) **Analysis of thermally-stable electron transport factors from the hyperthermophilic archaebacterium Pyrodictium brockii: Progress report.** Johns Hopkins Univ., Baltimore, MD (United States). Sep 1992. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-89ER14011. Order Number DE93003120. Source: OSTI; NTIS; GPO Dep.

The mechanisms by which hyperthermophilic archaebacteria grow and carry out metabolic functions at elevated temperatures have yet to be determined. The objective of this work is to develop an understanding of the metabolic characteristics of, and the electron transport enzymes involved in, hydrogen/sulfur transformation by hyperthermophilic archaebacteria. Efforts focus on the autotrophic H_2-oxidizing bacterium, Pyrodictium brockii which has an optimum growth temperature of 105°C. Biochemical and genetic characterization of enzymes involved in hydrogen oxidizing electron transport pathway. These including investigating the role of the membrane lipids in protecting the hydrogenase enzyme from thermal inactivation, characterization of a quinone and a c-type cytochrome, and analysis of the topology in the membrane in the net energy generating components are reported. The long-term goal is to understand some of the factors contributing to the biochemical basis of extreme thermophily.

329 (EUR–13026) **Italian Ryegrass as a source of fermentable sugars and protein feedstuff.** McGRATH, D. Commission of the European Communities, Luxembourg (Luxembourg). 1990. 33p. Contract No. EN 3B-0049-IRL. Source: OSTI; NTIS (US Sales Only).

The purpose of the investigation was (1) to investigate the potential of grasses, and of Italian ryegrasses in particular, to supply water-soluble (WSC) and (II) to examine the potential of the WSC component for ethanol production and of residual grass for animal feed. WSC production of 5 Italian ryegrass cultivars and of 17 other cultivars, representative of hybrid Italian and perennial ryegrasses and of tall fescue, timothy, and cocksfoot, were examined. 13 refs., 26 tabs.

330 (EUR–14017/1) **Landfill gas from environment to energy.** Gendebien, A. (Louvain Univ. (Belgium)); Pauwels, M.; Constant, M.; Ledrut-Damanet, M.J.; Nyns, E.J.; Fabry, R.; Ferrero, G.L.; Willumsen, H.C.; Butson, J. Commission of the European Communities, Luxembourg (Luxembourg). 1992. 865p. Contract 88-B-7030-11-3-17. Source: OSTI; NTIS (US Sales Only).

Landfill gas is an alternative source of energy which can be commercially exploited wherever municipal solid wastes are disposed of in sanitary landfills. In this context, it was decided to launch a comprehensive study on the subject of energy valorization of landfill gas. The main topics dealt with in the study, which is supported by a comprehensive literature survey and six detailed case-studies, include; (i) the environmental impact of landfill gas, (ii) the process of landfill gas genesis and the technology of landfill gas control by its exploitation, (iii) the monitoring of landfill gas emissions, (iv) the policies and legal aspects of landfill gas in the European Community and in the world, (v) the estimation of landfill gas potentials and economics of landfill gas control and exploitation, (vi) the status of landfill gas exploitation in the European Community and in the world. (authors). refs., figs., tabs.

331 (NEDO-P–9111) **Study of applicability of technology for fuel alcohol production.** New Energy and Industrial Technology Development Organization, Tokyo (Japan). Mar 1992. 198p. (In Japanese). Sponsored by New Energy and Industrial Technology Development Organization, Tokyo (Japan). Order Number DE93723963. Source: OSTI; NTIS.

The paper classifies biomass, raw material for alcohol production, into sugar, starch and lignocellulose groups and studies its raw material situation, the present status of ethanol production technology using these materials, applicability of new production technologies, problems of the new technologies and the future outlook with consideration thereof. As a new ethanol production technology from sugar biomass, presented is a continuous fermentation process using zymomonas developed in a joint study of NEDO and FARA (Fuel Alcohol Research Association). It is suggested that the production cost is lower than that in Melle Boinot method. The flash fermentation process developed by a NEDO-FARA joint research as a new ethanol production method from starch biomass suggests a possibility of about 6% reduction of the production cost, compared with the conventional batch method. The direct fermentation process using clostridium developed by a NEDO-FARA joint research as a new ethanol production technology from lignocellulose biomass suggests an approximate 72 yen/l reduction if the fermentation yield can be increased up to 90%. 74 refs., 59 figs. 67 tabs.

332 (NEI-DK–957, pp. 1-10) **The anaerobic option for solid waste processing.** Chynoweth, D.P. (Department of Agricultural Engineering, University of Florida, Gainesville, Florida (US)); Owens, J.M. Dansk Komite for Affald (DAKOFA), Copenhagen (Denmark). 1992. 278p. (CONF-9206295–: 1. International conference and exhibition on biological waste treatment, Herning (Denmark), 1-4 Jun 1992). In *Biowaste'92: Proceedings.* Order Number DE93721513. Source: OSTI; NTIS.

Sponsored by: ISWA and IAWPRC.

Aerobic composting and anaerobic, high-solids digestion (anaerobic composting) are both options for treatment of organic wastes. The main advantages of anaerobic composting are the lack of aeration requirements and production of methane. Despite these advantages, anaerobic composting is not well known while many aerobic solid waste treatment facilities are under operation, or being constructed in the U.S. The primary reasons for this are the public's greater familiarity with aerobic systems and the perceived difficulty in reliable operation of anaerobic systems now commercially available. (au) 27 refs.

333 (NEI-DK–957, pp. 1-7) **Biogas from source separated household waste: Project in Herning.** Moeller, H. (Herning Municipal Utilities (DK)); Bertelsen, F. Dansk Komite for Affald (DAKOFA), Copenhagen (Denmark). 1992. 278p. (CONF-9206295–: 1. International conference and exhibition on biological waste treatment, Herning (Denmark), 1-4 Jun 1992). In *Biowaste'92: Proceedings.* Order Number DE93721513. Source: OSTI; NTIS.

Sponsored by: ISWA and IAWPRC.

Herning Municipal utilities has in 1991 constructed a biogas plant for thermophilic digestion of source separated organic household waste and liquid manure in combination. In the research periode, treatment consists of pretreatment, digestion and posttreatment of 1,000 tons of source-separated organic household waste mixed with liquid manure in the ratio 1:4. The plant is situated next to the already existing biogasplant in Sinding-Oerre. So far the results seem very promising. The gasproduction is more than 100 Nm^3 gas per ton household waste and the produced fertilizer product is clean and with content of heavy metals below the limit value. The amount of material lost by separation is very low, less than 8 percent of the received household waste. (au).

334 (NEI-DK–957, pp. 1-6) **Full scale biogas plant for source separated solid waste.** Roegen, K.L. (Carl Bro A/S, Consulting Engineers and Planners, Glostrup (DK)); Kraemer, S. Dansk Komite for Affald (DAKOFA), Copenhagen (Denmark). 1992. 278p. (CONF-9206295–: 1. International conference and exhibition on biological waste treatment, Herning (Denmark), 1-4 Jun 1992). In *Biowaste'92: Proceedings.* Order Number DE93721513. Source: OSTI; NTIS.

Sponsored by: ISWA and IAWPRC.

The process plant has been designed to treat approx. 20,000 tons of biowaste or other types of organic matter per year. The receiving part of the plant will be in operation within "normal" working hours, whereas the process plant, including the pretreatment process, will be in continous operation. The plant will be constructed with automatic control and supervision, and the plant will only be manned when the receiving part is in operation ("normal working hours"). The multi-stage process utilized is based on decomposition of the biowaste, immediately after it has been received, to a type of pulp which can be pumped. Therefore, the internal transport at the plant mainly takes place in closed piping systems, and storage takes place in closed, gas-tight tanks. The process design is described in additon to the mass balance and the economy. (AB).

335 (NEI-DK–957, pp. 1-10) **Anaerobic digestion of combined waste.** Ahring, B.K. (Dept. of Biotechnology, The Technical University of Denmark, Lyngby (DK)); Angelidaki, I.; Johansen, K. Dansk Komite for Affald (DAKOFA), Copenhagen (Denmark). 1992. 278p. (CONF-9206295–: 1. International conference and exhibition on biological waste treatment, Herning (Denmark), 1-4 Jun 1992). In *Biowaste'92: Proceedings.* Order Number DE93721513. Source: OSTI; NTIS.

Sponsored by: ISWA and IAWPRC.

Combined anaerobic digestion of manure together with organic industrial waste and source-sorted household waste have been applied in the large-scale biogas plant in Denmark. Experiments performed in the plants showed that addition of industrial waste to reactors digesting cattle manure as basis substrate clearly increased the biogas yield of the reactors and at the same time stabilized the process. Addition of lipids can inhibit the biogas process. The inhibition can be overcome by inoculating with small amounts of cultures degrading long-chain fatty acids. Data from anaerobic digestion of source-sorted household waste in lab-scale reactors showed that this waste is highly degradable (approx. 80% conversion to biogas). This result was further confirmed by full-scale reactor experiments. (au) (13 refs.).

336 (NEI-DK–957, pp. 1-8) **Operational experience of a 360 t per day joint biogas plant.** Noergaard, P. (Krueger-Bigadan A/S (DK)); Vinge, M.; Buchhave, K. Dansk Komite for Affald (DAKOFA), Copenhagen (Denmark). 1992. 278p. (CONF-9206295–: 1. International conference and exhibition on biological waste treatment, Herning (Denmark), 1-4 Jun 1992). In *Biowaste'92: Proceedings.* Order Number DE93721513. Source: OSTI; NTIS.

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The joint biogas plant, named Linkogas A.m.b.A was started up in April 1990. The plant converts 360 ton of animal manure and organic waste per day into energy and environmentally friendly organic fertilizer. This paper presents the process, step by step, which includes reception of the slurry, pasteurization, mesophilic anaerobic digestion and final treatment. The final treatment includes mechanical separation and reverse osmosis. The operational experience and the energy balance for 1991 are presented, as well as the main financial data. (au).

337 (NEI-DK–957, pp. 1-6) **Full scale demonstration plant for anaerobic digestion of sorted municipal solid waste.** Szikriszt, G. (BIOMET AB, Sundbyberg (SE)); Koehlin, S.-E.; Kaellersjoe, L.; Frostell, B. Dansk Komite for Affald (DAKOFA), Copenhagen (Denmark). 1992. 278p. (CONF-9206295–: 1. International conference and exhibition on biological waste treatment, Herning (Denmark), 1-4 Jun 1992). In *Biowaste'92: Proceedings.* Order Number DE93721513. Source: OSTI; NTIS.

Sponsored by: ISWA and IAWPRC.

A possible future alternative for the treatment of organic material inmunicipal solid waste is anaerobic digestion at a TS concentration of around 10%. The results from a successful pilot plant experiment were reported. An existing 900 m^3 full scale anaerobic digester for municipal sludge was reconstructed for digestion of a mixture of sorted municipal solid waste and municipal sludge. The reconstruction of the anaerobic digester system involved the installation of a novel milling stage for size reduction of incoming waste, removal of unsuitable materials, such as glass, metals etc and preparation of a feedstock with a TS concentration of 10%. The anaerobic digester has been equipped with a mechanical mixing system. The system also comprises an internal water recirculation system, allowing a minimal production of waste water for further treatment. The retrofitted digester was started in September 1991 and the milling station and the separation system in April 1992. During the demonstration operation, the interest is focused on the following key areas: May the succesful results in a 20 m^3 pilot plant be realised also on a full scale? Is it possible to solve potential accumulation problems? Is the reliability and durability of the milling equipment chosen? In the paper, the full scale plant is presented as well as initial results of operation. (au).

338 (NEI-DK–957, pp. 1-8) **Anaerobic digestion of MSW: Evaluation of industrial facilities after three years of continuous operation.** Delecroix, P. (Valorga Process S.A. (FR)); Saint-Joly, C. Dansk Komite for Affald (DAKOFA), Copenhagen (Denmark). 1992. 278p. (CONF-9206295–: 1. International conference and exhibition on biological waste treatment, Herning (Denmark), 1-4 Jun 1992). In *Biowaste'92: Proceedings.* Order Number DE93721513. Source: OSTI; NTIS.

Sponsored by: ISWA and IAWPRC.

The VALORGA process is a technique for processing biodegradable organic wastes. The main objectives are to maximize the value of the organic matter and protection of the environment. The process is particularly suited for treating the fermentable fraction of Municipal Solid Wastes (MSW) coming from source separation but can be used entirely satisfactorily with a front-end sorting system after mixed MSW collection. When necessary, the refuse is sorted to separate biodegradable substances from materials which can be recycled (glass, ferrous metals) or burned. The fermentable fraction is subjected to Anaerobic Digestion in a oxygen-free tank called a DIGESTER. Anaerobic Digestion produces a large amount of methane-rich gas, called BIOGAS, which can be used in numerous ways. After treatment, the solid effluent forms a high quality organic enriching agent for the soil, called DIGESTATE. (au).

339 (NEI-DK–957, pp. 1-8) **A moderate land limited swine waste bio-treatment alternative for the tropics.** Yang, P.Y. (Agricultural Engineering Department, University of Hawaii at Manoa, Honolulu, Hawaii (US)); Yamamoto, D.K.; Chen, H. Dansk Komite for Affald (DAKOFA), Copenhagen (Denmark). 1992. 278p. (CONF-9206295–: 1. International conference and exhibition on biological waste treatment, Herning (Denmark), 1-4 Jun 1992). In *Biowaste'92: Proceedings.* Order Number DE93721513. Source: OSTI; NTIS.

Sponsored by: ISWA and IAWPRC.

An integrated biotreatment system including a modified hybrid anaerobic treatment for concentrated swine waste and combined anaerobic biofixed film and aquatic plant for dilute raw and anaerobically treated swine wastewater was investigated. It was found that the system could effectively remove both the organics (based on oxygen demand) and inorganics (based on nitrogen). Because of the nature of the design and operational criteria, these two biotreatment processes can be prefabricated into package plants which can further reduce the problems associated with technology transfer problems. The present system is considered to be more appropriate in the tropics where the land is moderately available. Also, the system can be modified easily for the recovery of bioenergy and animal feed, pollution control and reuse of treated wastewater. (au).

340 (NEI-DK–957, pp. 1-10) **Sequential batch anaerobic composting (SEBAC™) of solid wastes.** Chynoweth, D.P. (Department of Agricultural Engineering, University of Florida, Gainesville, Florida (US)); O'Keefe, D.M.; Barkdoll, A.W.; Owens, J.M.; Legrand, R. Dansk Komite for Affald (DAKOFA), Copenhagen (Denmark). 1992. 278p. (CONF-9206295–: 1. International conference and exhibition on biological waste treatment, Herning (Denmark), 1-4 Jun 1992). In *Biowaste'92: Proceedings.* Order Number DE93721513. Source: OSTI; NTIS.

Sponsored by: ISWA and IAWPRC.

Anaerobic high-solids digestion (anaerobic composting) is an attractive option for treatment of organic wastes. The main advantages of anaerobic composting are the lack of aeration requirements and production of methane. An anaerobic composting design, sequential batch anaerobic composting (SEBAC™), has been developed and demonstrated at the pilot scale which has proven to be stable and effective for treatment of the non-yeard

waste and yard waste organic fractions of municipal solid waste (MSW). The design employs leachate recycle for wetting, inoculation, and removal of volatile organic acids during startup. Performance is similar to that of other designs requiring heavy solids inoculation and mixing and which do not have a mechanism for volatile organic acid removal during imbalance. (au) (12 refs.).

341 (NEI-DK–957, pp. 1-10) **Enhancement of two step anaerobic degradation by enzyme addition.** Lagerkvist, A. (The Landfill Group, Luleaa University of Technology, Luleaa (SE)); Huimin Chen. Dansk Komite for Affald (DAKOFA), Copenhagen (Denmark). 1992. 278p. (CONF-9206295–: 1. International conference and exhibition on biological waste treatment, Herning (Denmark), 1-4 Jun 1992). In *Biowaste'92: Proceedings.* Order Number DE93721513. Source: OSTI; NTIS.

Sponsored by: ISWA and IAWPRC.

The addition of cellulolytic enzymes to MSW have been tried under methanogenic and acidogenic conditions in 0,1 m^3 landfill models. An enhanced degradation of MSW was observed in both cases. The enzyme additon did not result in a change from methanogenic to acidogenic conditions. The overall conversion of VS to gas was in excess of 50% in the methanogenic models. Enzyme addition appears to stimulate the degradation of VS and cellulose in particular. (au).

342 (NEI-DK–957, pp. 1-8) **Biological waste recycling in Chinese communities.** Chan, G. (Antenna Technology (CH)). Dansk Komite for Affald (DAKOFA), Copenhagen (Denmark). 1992. 278p. (CONF-9206295–: 1. International conference and exhibition on biological waste treatment, Herning (Denmark), 1-4 Jun 1992). In *Biowaste'92: Proceedings.* Order Number DE93721513. Source: OSTI; NTIS.

Sponsored by: ISWA and IAWPRC.

In traditional China, both human and animal wastes have never been a problem because every family was responsible for the collection and disposal of its own wastes. It was not because of any law of the land. To the Cinese man, woman and child all wastes were considered as valuable resources that should be recycled as nutrients in the soil to make plants grow in order to produce food to survive, and to grow feed for domestic animals and birds, fibre for clothing, and fiber for wooden parts of buildings and furniture, with the residues used as firewood. All these basic needs were dependent on the proper management of wastes which were produced every day, in peace as well as in war time. They allowed China to feed a big and increasing population on limited arable land for millenia, and helped maintain the longest civilisation on earth. In this paper, we look at various case studies of biological waste established villages, small towns, district and county towns, provincial capitals, and the interaction between rural, suburban and urban areas. We also look at the positive improvements of the traditional systems, the dubious benefits of adding external artificial inputs to them, and the negative effects of modern development on the physical and cultural environment. We should not just look at the financial gains, which are undoubtedly very impressive despite excessive wastage of our limited resources, but we should not ignore the hidden costs of pollution that we force upon our future generations to pay for our irresponsible neglect. (au).

343 (NEI-DK–957, pp. 1-5) **Anaerobic conversion of biowaste by means of the Dranco process.** Six, W. (Organic Waste Systems, Gent (BE)); Baere, L. De. Dansk Komite for Affald (DAKOFA), Copenhagen (Denmark). 1992. 278p. (CONF-9206295–: 1. International conference and exhibition on biological waste treatment, Herning (Denmark), 1-4 Jun 1992). In *Biowaste'92: Proceedings.* Order Number DE93721513. Source: OSTI; NTIS.

Sponsored by: ISWA and IAWPRC.

The Dranco process has been developed for the conversion of solid organic wastes, specifically the organic fraction of municipal solid waste, to energy and a humus-like product, called Humotex. The process can be compared to a landfill gas production process, accelerated by a factor 1000. A Dranco installation with a digester of 808 m^3 treating 10.500 tons of source separated organic wastes per year. A demonstration plant of 56 m^3 in Gent, using mixed garbage as feedstock between 1984 and 1991, and source separated waste since July 1991 is also discussed. The operating temperature in the digester is 55 deg. C and the total solids concentration is ca. 32%. During the operation using the organic fraction of mixed garbage as a feedstock, the mean gas production rate was 3.3 Nm^3 $CH_4/m^3_{reactor}$.day, the volumetric loading 17.3 kg $COD/m^3_{reactor}$.day and the COD-reduction 55%. During the operation using the source separated organic fraction as a feedstock the mean gas production rate was 2.2 Nm^3 $CH_4/m^3_{reactor}$.day, the volumetric loading 11.4 kg $COD/m^3_{reactor}$.day and the COD-reduction 52%. The gas production process takes in 3 weeks. The final product is dewatered and further stabilized. The Humotex is free of pathogens. Low concentrations of heavy metals can only be obtained through separte collection of garbage. (AB).

344 (NEI-DK–957, pp. 1-7) **The effect of process aiders on start-up of anaerobic fluidized bed systems.** Motta Marques, D.M.L. Da (Setor de Saneamento Ambiental, Instituto de Pesquisas Hidraulicas, Porto Alegre-RS (BR)); Cayless, S.M.; Lester, J.N. Dansk Komite for Affald (DAKOFA), Copenhagen (Denmark). 1992. 278p. (CONF-9206295–: 1. International conference and exhibition on biological waste treatment, Herning (Denmark), 1-4 Jun 1992). In *Biowaste'92: Proceedings.* Order Number DE93721513. Source: OSTI; NTIS.

Sponsored by: ISWA and IAWPRC.

In order to study the start-up of anaerobic fluidized bed (AFBS) treating ice-cream factory wastewater, several start-up protocols were tested applying different aiders while the organic load was increased stepwise. These aiders were: biological preconditioning of the wastewater in a continuous flow-stirred tank reactor at constant hydraulic retention time; chemical preconditioning of the wastewater with the supplementation of $CaCl_2$, a misture of detergents (anionic and nonionic surfactants) and the addition of Coenzyme M (2-mercaptoethanesulphonic acid) during the seeding period. The protocols enchanced the AFBS start-up performance. Each start-up protocol increased the maximum efficiency of COD removal for the range of organic loading applied by comparison with the control system, although the best substrate removel efficiency was not associated with the best methane yield. (au).

345 (NEI-DK–957, pp. 1-6) **Aerobic and anaerobic treatability studies of pulp and paper industry waste waters.** Eroglu, V. (Istanbul Technical University, Faculty of Civil Eng., Environmental Engineering Dept., Maslak, Istanbul (TR)); Ozturk, I.; Sarikaya, H.Z. Dansk Komite for Affald (DAKOFA), Copenhagen (Denmark). 1992. 278p. (CONF-9206295–: 1. International conference and exhibition on biological waste treatment, Herning (Denmark), 1-4 Jun 1992). In *Biowaste'92: Proceedings.* Order Number DE93721513. Source: OSTI; NTIS.

Sponsored by: ISWA and IAWPRC.

Low COD removal efficiencies and excessive biological sludge problems associated with pulp and paper mill waste waters were addressed. Pilot and full scale experiences on aerobic biological treatment and lab-scale anaerobic treatability of waste water of an integrated pulp and paper mill were presented. Inert fraction of COD was determined using simultaneous 3-liter volume aerobic reactors fed with glucose and waste water. It was found that inert COD concentration is about 700 mg/l which is about 45 percent of initial COD. Low COD removal efficiency of the full scale plant was atributed to high inert COD content. Anaerobic treatability studies were carried out by an upflow anaerobic sludge blanket reactor (UASBR) with a volume of 10.35 liter. COD removal of 55% was achieved at UASBR operated at 33 $\pm$ 2 deg. C with detention time of 24 h. It is estimated that 70 percent of energy saving and about 65 percent reduction in excess biological sludge production is passible by applying anaerobic pretreatment to pulp and paper mill waste water. (au).

346 (NEI-DK–957, pp. 1-6) **Anaerobic pretreatment of university-hospital waste water.** Tsonis, S.P. (Environmental Technology Laboratory, Department of Civil Engineering, University of Patras, Patras (GR)). Dansk Komite for Affald (DAKOFA), Copenhagen (Denmark). 1992. 278p. (CONF-9206295–: 1. International conference and exhibition on biological waste treatment, Herning (Denmark), 1-4 Jun 1992). In *Biowaste'92: Proceedings.* Order Number DE93721513. Source: OSTI; NTIS.

Sponsored by: ISWA and IAWPRC.

Anaerobic pretreatment of the two main waste water streams from the Patras University Campus [a hospital waste water stream and the waste water from all the other activities (university waste water stream)], in four different anaerobic systems and under a variety of operational conditions, is presented in this work. The anaerobic systems studied were 3 anaerobic contact units with sludge recycle, a U-type tube digester, a longitudinal anaerobic tank and a full scale cylidrical-conical deep anaerobic tank. The waste water treated resembled domestic sewage and the anaerobic systems studied, at temperatures sewage and the anaerobic systems studied, at temperatures 7-37 deg. C and hydraulic retention times 2-72 h, effected only limited soluble organics removals (20-33% in terms of COD). (au) (13 refs.).

347 (NEI-DK–957, pp. 1-6) **The role of gene technology in biological waste treatment.** Lund, E. (The Royal Veterinary and Agricultural University of Copenhagen (DK)). Dansk Komite for Affald (DAKOFA), Copenhagen (Denmark). 1992. 278p. (CONF-9206295–: 1. international conference and exhibition on biological waste treatment, Herning (Denmark), 1-4 Jun 1992). In *Biowaste'92: Proceedings.* Order Number DE93721513. Source: OSTI; NTIS.

Sponsored by: ISWA and IAWPRC.

This presentation contains a review of rules and regulations for the deliberate release of genetically modified organisms (GMO's) into the environment. The emphasis is on the EEC directives, also exemplified in the 1991 Danish Law. The OECD has formed a working group on Biotechnology for a Clean Environment. This troup studies examples of beneficial effects of the employment of GMO's to clean up the environment from various pollutants. (au).

348 (NEI-DK–969) **Expanded measuring programme on farm biomass conversion plants.** Hinge, J. Nordvestjysk Folkecenter for Vedvarende Energi, Hurup (Denmark). Mar 1992 38p. (In Danish). Contract ENS-UVE-90.0153. Order Number DE93721410. Source: OSTI; NTIS.

Data was collected and operation results registered in connection with a number of biomass conversion plants located on farms. The data collection programme DATIND was further developed in order that it should be an efficient tool for data registration and monitoring of plants. Currently, there exist various kinds of biomass conversion plants where the technical and process operation has been documented over longer periods. Many plants are highly automated to an extent which minimizes the amount of daily work to 10-15 minutes. It is stated that for many Danish farms, especially those which hold pigs as livestock, experience economical advantage after investment in biomass conversion plants as the heating of barns for large numbers of pigs involves the necessity of producing a significant amount of heat - also because it will not be necessary to supplement the farm's pig manure biomass with light organic municipal wastes. It is recommended to concentrate on the development of low-cost bioconversion systems, for example manure slurries in storage tanks, in order to make life easier for the farmer. (AB).

0910 Properties and Composition

Refer also to citation(s) 351

349 (NEI-DK–957, pp. 1-6) **An automated gas analyser for kinetic studies on the anaerobic decomposition of high solids wastes.** Kidby, D.W. (AEA Technology Dept., Harwell Laboratories, Oxon (GB)); Purdom, G.J. Dansk Komite for Affald (DAKOFA), Copenhagen (Denmark). 1992. 278p. (CONF-9206295–: 1. International conference and exhibition on biological waste treatment, Herning (Denmark), 1-4 Jun 1992). In *Biowaste'92: Proceedings.* Order Number DE93721513. Source: OSTI; NTIS.

Sponsored by: ISWA and IAWPRC.

This poster describes an automated analyser for the monitoring of gas production and composition for laboratory scale anaerobic degradation of high solids waste. The advantages realised from the modular nature of the apparatus are indicated. The operational potential has been assessed during the degradation of a highly cellulosic waste with a sewage sludge inoculum. (au).

0920 Combustion

Refer also to citation(s) 18, 885

350 (NEI-DK–957, pp. 1-5) **Small bio-fuel fired CHP-plant.** Astrupgaard, N.P. (dk-TEKNIK, Soeborg (DK)). Dansk Komite for Affald (DAKOFA), Copenhagen (Denmark). 1992. 278p. (CONF-9206295–: 1. International conference and exhibition on biological waste treatment, Herning (Denmark), 1-4 Jun 1992). In *Biowaste'92: Proceedings.* Order Number DE93721513. Source: OSTI; NTIS.

Sponsored by: ISWA and IAWPRC.

This report is an investigation concerning small CHP-plants base on biomass. The project is based on application of serially produced prefurnaces for combustion of bio-mass in connection with ordinary industrial steam boilers of the fire-tube boiler type, as exactly a reduction of the price for the boiler type components is the actual idea of the project. The plant consists of two prefurnaces connected to the boiler, producing 3.2 T/h steam at 26 bar a., 380 deg. C superheating. The steam is expanded in a newly developed steam engine to vacuum at 0.66 bar a., 88 deg. C, thereby producing approx. 500 kW of electricity. The heat production-capacity is 2 MW, resulting in a power/heat ratio of approx. 25%. Economic calculations based on a budget of approximately 8.5 Million DKK and an equivalent full load timefigure of 6000 hours/year result in payback times of approx. 4.5 - 7.5 years. (au).

351 (NEI-DK–979) **IEA round robin analysis of straw and straw ashes.** Nielsen, C.; Westborg, S. (eds.). DK-Teknik, Soeborg (Denmark). Jan 1992 71p. Order Number DE93721403. Source: OSTI; NTIS.

Prepared for IEA-Biomass Conversion Task VII.

The aim was to investigate which analytical methods are used in different countries to characterize straw for energy utilization and to which extent the methods influence the result. A round-robin test for the analysis sample of a straw and sample of straw ash was completed. Laboratories from Austria, Denmark, Sweden and the United Kingdom participated. Recommendations for suitable analytical methods are given. The methods were used in relation to the determination of moisture and ash content in addition to sulphur, chlorine, carbon, hydrogen, nitrogen, lead, cadmium, copper, mercury, phosphorus, silicum, iron, aluminium, calcium, magnesium, sodium, potassium and unburned matter. The fusibility of the ash and the calorific value were also investigated. (AB).

352 **Furnace for biological fuels.** Svensson, E. 24 Jul 1992. Filed date 23 Jan 1991. Canada Patent patent application 2034773. 16p. Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN.

A furnace for biomass fuels is provided in which the combustion is effected downwards in order allow firing down to a very low output. According to the invention, the furnace has a fuel storage vessel which also serves as a gas collection vessel and which, during operation, is pressurized to a slight atmospheric overpressure. The bottom part of the storage vessel is formed with sloping walls, the lower edges of which form a burner opening. Above this opening, a draft air supply means extends closely alongside the sloping bottom along the portions of the bottom positioned closest to the burner opening. The furnace of the invention overcomes problems of previously known furnaces for biomass fuels which have high emissions and low efficiency when the heat extraction is low. 5 figs.

0930 Economic, Industrial, and Business Aspects

353 (NEI-DK–957, pp. 1-9) **Aspects of biogas utilisation: Practical possibilities and limitations.** Luning, L. (Grontmij Consulting Engineers, De Bilt (NL)). Dansk Komite for Affald (DAKOFA), Copenhagen (Denmark). 1992. 278p. (CONF-9206295–: 1. International conference and exhibition on biological waste treatment, Herning (Denmark), 1-4 Jun 1992). In *Biowaste'92: Proceedings.* Order Number DE93721513. Source: OSTI; NTIS.

Sponsored by: ISWA and IAWPRC.

Utilisation of biogas has received considerable attention over the last decade, its full potential has not been reached however. The

paper discusses various options for utilisation of biogas and the limitations that may occur as far as they are associated with the characteristics of biogas. As a result the prospects for the future are presented. (au).

0940 Transport, Handling, and Storage

Refer also to citation(s) 324

0950 Environmental Aspects

Refer also to citation(s) 330

354 (EUR–14330) **Treatment and use of sewage sludge and liquid agricultural wastes. Review of COST 68/681 programme, 1972-90.** Hall, J.E. (Water Research Association, Medmenham (United Kingdom)); Newman, P.J.; L'Hermite, P. Commission of the European Communities, Luxembourg (Luxembourg). 1992. 230p. Source: OSTI; NTIS (US Sales Only); INIS.

This report summarizes the activities of the Community concerted action programme (finally termed COST 681) on the treatment and use of sewage sludge, and latterly of liquid agricultural waste, from its inception in the early 1970s to the end of 1990. It was prepared by WRC of the UK on behalf of DG XII of the Commission of the European Communities. (author). refs., Figs., Tabs.

355 (NEI-DK–957, pp. 1-11) **Emissions from composting plants.** Muesken, J. (University of Stuttgart (DE)); Bidlingmaier, W. Dansk Komite for Affald (DAKOFA), Copenhagen (Denmark). 1992. 278p. (CONF-9206295–: 1. International conference and exhibition on biological waste treatment, Herning (Denmark), 1-4 Jun 1992). In *Biowaste'92: Proceedings.* Order Number DE93721513. Source: OSTI; NTIS.

Sponsored by: ISWA and IAWPRC.

The points, where relevant emissions of a composting plant are generated, can be determined from the process flow sheet. Emissions occur via the water, air and soilpaths. Critical points are the receiving area, the pre-treatment procedure, the rotting area, the post-treatment procedure and finally the compost itself. The main point, where leachates are produced, is the rotting area. The BOD_5 of the leachates reaches values up to 39000 mg O_2/l. The amount of this waste water can be reduced by using suitable techniques, such as closed systems or sheltered piles. Treatment of the wastewater is necessary in any case. The heavy metal contents in composts made from separately collected organic matter are very low. In respect to German legislation there is no problem involved in using this compost for horticultural purposes. On the basis of existing data, it can be said that the contents of organic pollutants are extremely low in these composts. Partly they can be eliminated by the rotting process. Ideally, the discharge of these substances into the environment must be avoided, where they are produced and utilized. Odour emissions, which are generated during the delivering, the treatment and the rotting processes can be avoided by using closed facilities and exhaust air collection systems as well as by purification of this exhaust air, e.g. in biofilters. At the moment it is difficult to calculate the odour emissions from open piles, because the methods for doing so have yet to be developed. By using a qualified rotting system, the emissions can be reduced to an acceptable level. (au).

0970 Legislation and Regulations

Refer also to citation(s) 330

0990 Products and By-Products

356 (NEI-DK–957, pp. 1-3) **Differences in nitrogen fertilizing effect from anaerobically digested and untreated cattle slurry.** Oertenblad, H. (The Danish Agricultural Advisory Centre, Aarhus (DK)). Dansk Komite for Affald (DAKOFA), Copenhagen (Denmark). 1992. 278p. (CONF-9206295–: 1. International conference and exhibition on biological waste treatment, Herning (Denmark), 1-4 Jun 1992). In *Biowaste'92: Proceedings.* Order Number DE93721513. Source: OSTI; NTIS.

Sponsored by: ISWA and IAWPRC.

For three years field experiments have been conducted to find out if there is any difference in the nitrogen fertilizing effect of anaerobic digested and untreated cattle slurry. The experiments were made in spring barley and showed an average N-efficiency of 64 per cent from applied anaerobic digested slurry and 50 per cent from applied untreated slurry. The N-efficiency is defined as the amount of nitrogen in mineral fertilizer which 100 kg of total-nitrogen inslurry can replace. The difference in N-efficiency can be explained by mesurements of soil mineral nitrogen and losses by denitrification. Soil mineral nitrogen measurements showed losses of 10-15 per cent of the ammonia content in the digested slurry and of 25 per cent in the untreated slurry (compared to mineral fertilizer). The digestion of the slurry resulted in a 75 per cent decrease in losses by denitrification corresponding to 15 kg N/ha. (au).

10 SYNTHETIC FUELS

1002 Production

357 (NEDO-P–9114) **Survey of alcohol production technology using coalbed methane as raw material.** New Energy and Industrial Technology Development Organization, Tokyo (Japan). Mar 1992. 156p. (In Japanese). Sponsored by New Energy and Industrial Technology Development Organization, Tokyo (Japan). Order Number DE93723966. Source: OSTI; NTIS.

This paper reviews properties, geological conditions and scales of coalbed methane and makes a feasibility study in case of using it as a raw material of fuel use alcohol. Since coalbed methane exists in a wide area, an organized pipeline network over a large area is needed to use it. The feasibility study is conducted in the following case: Coalbed methane as raw material, which is supposed to be produced in Australia, is transported by pipeline to the seashore. Using the system combining a synthetic gas production process by the two step combined reforming method and a synthetic method by the gas phase fluidized bed, fuel methanol is produced in a scale of 5000 tons/day and transported to Japan by a private tanker. As a result, proposals are made for the taxation system, development of the otto type engine and establishment of fuel alcohol production technology. 116 refs., 40 figs., 24 tabs.

13 HYDRO ENERGY

358 (KTM/E-B–112) **Potential of hydro power and its utilization possibilities.** Kovanen, T. (ed.). Ministry of Trade and Industry, Helsinki (Finland). 1992. 47p. (In Finnish). Project KTM-148/881/90. Order Number DE93721595. Source: OSTI; NTIS.

The total amount of small scale (no more than 1 MW) hydro power was estimated to be 370 MW (calculated with the mean discharge) of which almost 50 MW is already utilized. About 150 MW of underdeveloped small scale hydro power is not protected by law. It is estimated that rather easily about 60 MW could be developed with installed capacity of 80 MW (0.35 TWh/a). Undeveloped hydro power with capacity of more than 1 MW amounts to 770 MW. Of the total amount 400 MW lies in protected rivers or rapids. Main part of the unprotected capacity lies in rivers which serve as boundaries and only 50 MW lies elsewhere. The installed capacity of this 50 MW could be about 85-125 MW (0.25 TWh/a). The Vuotos reservoir would give installed capacity of 35 MW (0.36 TWh/a). The most important hydro power projects which are to-day prohibited by the protection laws were in Ounasjoki river, in middle and upstream parts of Iijoki river and in downstream part of Kymijoki river. The total installed capacity would have been 640 MW (2 TWh/a). New capacity may be obtained also with repairing existing plants or with adding new turbines. The total additional capacity could be 114 MW (0.20 TWh/a). The additional turbines in Kemijoki river could give 250 MW (0.11 TWh/a). About 12.6 TWh/a (2800 MW) of hydro power potential in Finland has been developed already. The capacity which could still be developed is 3.4 TWh/a (installed capacity about 1100 MW). The figures include repairing of existing power plants. Without the rivers flowing along the borders

of the country only 1.4 TWh/a (about 560 MW as installed capacity) could be developed. The amount of hydro power in protected rivers or rapids is 3.7 TWh/a (as installed capacity 900 MW).

359 (KTM/E-B–113) **Small-scale hydro power and its development possibilities.** Oksanen, S. (ed.). Ministry of Trade and Industry, Helsinki (Finland). 1992. 57p. (In Finnish). Project KTM-148/881/90. Order Number DE93721596. Source: OSTI; NTIS.

The small scale hydro power potential in Finland in the range of 50-1000 kW is estimated to be about 151 MW (calculated with the mean discharge). The potential lies in 861 rivers or rapids not protected by any Finnish law. The corresponding energy potential is about 0,9-1,3 TWh/a. It is estimated that about 60 MW lies in locations with existing dams or power plants out of service. The installed capacity in these locations could be about 80 MW and average annual production capacity 0.35 TWh. The operating environment for small scale hydro developers has changed. The cost survey of small scale hydro plants established during the 1980's indicates that new, simplified and cost efficient technological solutions have reduced the investment costs in real terms. There are only a few domestic plant/turbine manufacturers in Finland but their product ranges together cover most of the typical turbine types applicable at the Finnish low head hydro sites. The trend has been towards the standard tubular turbines (both Kaplan and Semi-Kaplan), compact propeller turbines with asynchronous generators, more careful landscaping, low buildings or hidden construction, and advanced electrical and control equipment. The study also deals with the institutional and other barriers of small scale hydro power construction, and gives recommendations for facilitating small hydro projects. Guidebooks and standardized application forms are recommended for easier construction permit application procedure. The role of electricity distribution utilities in exploiting the small scale hydro potential in Finland is emphasized.

1301 Resources and Availability

Refer also to citation(s) 1651

360 (LBL–32063) **San Joaquin-Tulare Conjunctive Use Model: Detailed model description.** Quinn, N.W.T. Lawrence Berkeley Lab., CA (United States). Mar 1992. 254p. Sponsored by Department of the Interior, Washington, DC (United States). DOE Contract AC03-76SF00098. Order Number DE93001536. Source: OSTI; NTIS; GPO Dep.

The San Joaquin - Tulare Conjunctive Use Model (SANTUCM) was originally developed for the San Joaquin Valley Drainage Program to evaluate possible scenarios for long-term management of drainage and drainage - related problems in the western San Joaquin Valley of California. A unique aspect of this model is its coupling of a surface water delivery and reservoir operations model with a regional groundwater model. The model also performs salinity balances along the tributaries and along the main stem of the San Joaquin River to allow assessment of compliance with State Water Resources Control Board water quality objectives for the San Joaquin River. This document is a detailed description of the various subroutines, variables and parameters used in the model.

361 (OY/PSTL-TIED–81) **The labour effects and other effects of the Vuotos reservoir on rural economy.** Kaihua, V.M. Oulu Univ. (Finland). Research Inst. of Northern Finland. 1992. 79p. (In Finnish). Order Number DE93721626. Source: OSTI; NTIS; INIS.

The labour and the other occupational effects of construction of the Vuotos reservoir in the surroundings of it and in the rural area of Lappland have been estimated in this publication. The Vuotos reservoir would be constructed in the Kemijoki. The reservoir would be sited mainly in the commune of Pelkosenniemi, but parts of it would also be in the communes of Salla and Savukoski. The communes of Sodankylae and Kemijaervi would belong to the nearby region. The need for labour has been estimated on the basis of models based on technical data and the amount of work needed, cost-benefit models and on the basis of the portions of cost estimates and wages. The additional effects have been estimated on the basis of studies made for the previous corresponding tasks. The clearing work, and both the soil and water works construction would case most work opportunities, the total labour need being 1700 to 2500 man-years. The large variation is caused by the fact that the requirements of the court of water on e.g. clearing are not known, and not how the work will be organized. About 15 % more people would be employed in the surrounding communities and about 30 % more in the rural area of Lappland via additional effects, than the actual employment effect would be. 40 to 65 sustainable working places would become into fishing, energy production and tourism, and 21 to 32 working places would be lost in agriculture, reindeer husbandry and forestry. The portion of the industry of the nearby region of the total contractive works would be 80-100 million FIM and that of the rural area of Lappland 150-180 million FIM. The gross income in the rural area of Lappland would be 190-230 million FIM, and those of the nearby communes 100-140 million FIM. Additionally, delivery of goods and compensations for real estates remaining under water would bring income.

1303 Plant Design and Operation

Refer also to citation(s) 364, 423

1305 Economic, Industrial and Business Aspects

Refer also to citation(s) 361

1306 Environmental Aspects

Refer also to citation(s) 1553, 1628, 1629, 1669

1307 Power-Conversion Systems

362 **Power generating apparatus for converting a potential energy to a power output.** Liao, KuoChen; Chen, Mei C. 29 Jun 1992. Filed date 28 Dec 1990. Canada Patent patent application 2033402. 19p. Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN.

An apparatus for converting the potential energy of a reservoir into a power output includes a pair of cylinders, each having a piston and a piston rod. The piston rods are coupled to two axles of a crank. Each cylinder has an inlet pipe to the reservoir. An inlet valve is coupled to each inlet pipe in order to control the flow of water. When the inlet valve is opened, water from the reservoir may flow into the cylinder in order to push the piston so that the crank is driven to rotate and generate a power output by the crank. 5 figs., 1 tab.

363 **System for hydraulically generating mechanical energy.** Tremblay, J. 12 Jun 1992. Filed date 11 Dec 1990. Canada Patent patent application 2031989. 29p. Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN.

A system for hydraulically generating mechanical energy comprises a chain device, a pair of rotatable wheels, and a reservoir containing liquid. The chain device defines a closed loop and comprises a series of spherical balls spaced apart from each other by a constant distance. The wheels each define a rim surface on which the chain device is mounted in order to enable longitudinal movement of the chain and to guide the same as it moves longitudinally. These wheels have the same diameter, lie in a first common vertical plane, and rotate about respective rotation axes both lying in a second vertical plane perpendicular to the first one. The reservoir opens through a vertical tubular member whose length is longer than the spacing between the balls on the chain device. The chain device includes a vertical section extending into the reservoir and the tubular member. In operation, the liquid in the reservoir produces by gravity a pressure on the balls when situated in the tubular member to cause longitudinal movement of the chain device and rotation of the wheels, thereby generating mechanical energy. In one embodiment, a number of reservoirs and chain devices are used to generate power from tides. 4 figs.

1308 Health and Safety

364 (ETDE-IT–92-95) **Safety of large dams: Chapter 10 of 'Engineering safety'.** Fanelli, M. Ente Nazionale per l'Energia Elettrica, Milan (Italy). Centro di Ricerca Idraulica e Strutturale. 1990. 30p. Order Number DE93729464. Source: OSTI; NTIS (US Sales Only).

In establishing basic criteria for the 'monitoring for safety' of large dams, i.e., structures more than 10 m high, or retaining more than 100,000 cubic meters of water (currently, there are 16,000 world-wide), this paper focusses on three fundamental steps: the frequent monitoring, with permanent sensors installed in the dam, of key quantities, e.g., displacements, strains, seepage, etc., characterizing the structural response of the dam to changing environmental actions; simultaneous monitoring of quantities such as water level, water and air temperatures, facing or internal temperatures, etc.; real time evaluation of the 'acceptability' of the response of the dam. In illustrating how these monitoring steps are carried out, the author draws on his own experience within the framework of ENEL (Italian National Electricity Board) activities.

14 SOLAR ENERGY

1403 Economic, Industrial, and Business Aspects

Refer also to citation(s) 374

365 (INIS-mf–13363, pp. 40-47) **The economics of water pumping in Sudan.** Sid-Ahmed, M.O. (National Council for Research, Khartoum (Sudan). Energy Research Council). Czechoslovak Solar Energy (Czechoslovakia); Ceske Vysoke Uceni Technicke, Prague (Czechoslovakia). 1991. 100p. (CONF-9107237–: Renewable energy sources '91 international conference, Prague (Czechoslovakia), 1 Jul 1991). In *Renewable energy sources '91. Part 3: Conference report, post-deadline papers.* Order Number DE93605594. Source: OSTI; NTIS (US Sales Only); INIS.

The paper is based on a survey performed by the Energy Research Council. The survey included the performance of 15 diesel pumps, 5 solar pumps and 10 wind pumps. The performance of the different types of pumps is discussed. The results of an economic analysis of water pumping have shown that renewable energy has a potential for replacing diesel fuel in locations where solar radiation exceeds 22 MJm^{-2}/day, or where the mean wind speed exceeds 4.8 ms^{-1}. (author) 2 tabs., 2 figs., 3 refs.

366 (NEI-FI–168, pp. 73-80) **NAPS-WIND/PV/Diesel projects.** Finnish Wind Power Association, Espoo (Finland). 1990. (CONF-9010521–: FINNWIND'90: conference on wind power in Finland, Pori (Finland), 19-20 Oct 1990). In *Finnwind'90: Presentations.* 120p. Order Number DE93721624. Source: OSTI; NTIS.

Selected projects Neste Advanced Power Systems (NAPS).

Finland, due to its seasonal variation in climate has given Neste Advanced Power Systems (NAPS) invaluable experience in promoting, designing and operating alternative energy systems. A selection of these systems is presented in the text. The variety in applications range from largest photovoltaic plant in Nordic countries located in Southern Finland, to small photovoltaic systems in Northern Lapland. Some selected projects are presented.

367 (NEI-FI–168, pp. 81-86) **NAPS renewable energy systems R and D.** Spiers, D.J. (Neste Oy, NAPS (Finland)). Finnish Wind Power Association, Espoo (Finland). 1990. (CONF-9010521–: FINNWIND'90: conference on wind power in Finland, Pori (Finland), 19-20 Oct 1990). In *Finnwind'90: Presentations.* 120p. Order Number DE93721624. Source: OSTI; NTIS.

Neste Advanced Power Systems (NAPS) is a renewable energy systems company supplying complete power systems based on photovoltaics, wind turbine generator, diesel generators, or hybrid systems combining two or more of these. Except for a few demonstration systems linked to the electricity grid, these are stand-alone power supplies which include storage batteries. Our present market areas are: Domestic systems for remote houses, largely in the Nordic countries. Systems for developing countries, mostly for lighting, health care and water supply and industrial and professional systems for use anywhere in the world, mainly for telecommunications and navigation aids.

1405 Solar Energy Conversion

Refer also to citation(s) 375, 387, 1092, 1182

368 (CONF-9205243–) **Sixteenth DOE Solar Photochemistry Research Conference: Proceedings.** Argonne National Lab., IL (United States). [1992]. 246p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. From 16. DOE solar photochemistry research conference; Delavan, WI (United States); 31 May - 4 jun 1992. Order Number DE93001760. Source: OSTI; NTIS; GPO Dep.

The conference brings together contractors and grantees engaged in research on photochemical energy conversion to foster cooperation, collaboration, and exchange of current research ideas. The meeting provides an opportunity for cross-fertilization and synergistic interaction among investigators who share common long-range goals of producing low-cost fuels and chemicals or electricity by photochemical conversion of solar energy. The program this year encompassed the topical areas of transition metal photochemistry and photophysics, electron transfer, photosynthesis, photoelectrochemistry, organic photochemistry, and photoredox chemistry in heterogeneous environments. This volume contains the agenda for the meeting, abstracts of 30 formal presentations and 54 posters, a record of question/answer discussions, as well as the participant list and an author index. (DLC)

369 (EUR–13897) **European solar test installation (ESTI). Qualification test procedures for crystalline silicon photovoltaic modules.** Ossenbrink, H. (Commission of the European Communities, Ispra (Italy). Joint Research Centre); Rossi, E. Commission of the European Communities, Luxembourg (Luxembourg). 1992. 39p. Source: OSTI; NTIS (US Sales Only).

This recommendation lays down the control tests applied by the Joint Research Centre for the qualification of crystalline silicon photovoltaic (PV) modules. The general objective of these tests is to asses relative performances and to identify environmental factors and design features which could affect the attainment of a sufficiently long life-time. This document is issued for the purpose of updating previous specifications. Performance and qualification tests have been revised in order to adjust for terrestrial PV module technology developments and to take into account a growing body of knowledge from experience in the field.

370 (NEI-DK–950) **Solar cell technology in Denmark: Photovoltaic technology in Denmark. Status, and draft for a plan of management.** PA Energy A/S, Malling (Denmark). Apr 1992 63p. (In Danish). Contract ENS-51181-91.0070. Order Number DE93721437. Source: OSTI; NTIS.

Solar cell, or photovoltaic technology is an attractive energy technology where part of the energy content of solar light is directly converted to electricity without the use of moveable parts, and where hardly any maintenance is required. An investigation was made of the present Danish status in this field, and it was found that the technology is fairly advanced but a general ignorance of this fact combined with previously high prices have limited further development. Latterly, prices have dropped. The technology, it was found, has a long service-life (<20 yrs.) and does not constitute an environmental hazard. The source of this energy has limitations related to source non-availability at night and in cloudy weather but various uses have been found for solar cells and these are expected to increase. Danish producers of this technology, consultants and information centers exist, and these are concerned mostly with exports and developing countries. It is currently difficult to find Danish data which could be used as a basis for evaluation of Danish solar cell technology. At the moment, it is claimed, there does not seem to be a basis for instigating a plan of management for the systematic promotion of photovoltaic conversion in Denmark. It is recommended that Danish actors participate in international cooperation regarding technological research in this field and more well documented national demonstration projects should

be carried out. This could be followed by a phase of systematic introduction and promotion of photovoltaic conversion in Danish energy supply. (AB) (50 refs.).

371 (NEI-DK–955) **Photovoltaics.** Kainberger, R. Nordvestjysk Folkecenter for Vedvarende Energi, Hurup (Denmark). Jun 1992 77p. Order Number DE93721382. Source: OSTI; NTIS.

The principles of photovoltaic conversion and the design and components of solar cells are described. Much attention is given to batteries in this connection. The planning and dimensioning of photovoltaic systems is explained and the use of photovoltaic systems in connection with solar water pumping is dealt with. Technological aspects are described in detail. Results of measurements on a water pump driven by photovoltaic energy are given. (AB).

372 (NREL/TP–451-5094) **Polycrystalline thin film materials and devices: Annual subcontract report, 16 January 1991–15 January 1992.** Baron, B.N. (Delaware Univ., Newark, DE (United States). Inst. of Energy Conversion); Birkmire, R.W.; Phillips, J.E.; Shafarman, W.N.; Hegedus, S.S.; McCandless, B.E. National Renewable Energy Lab., Golden, CO (United States); Delaware Univ., Newark, DE (United States). Inst. of Energy Conversion. Oct 1992. 107p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-83CH10093. Order Number DE93000022. Source: OSTI; NTIS; GPO Dep.

Results of Phase II of a research program on polycrystalline thin film heterojunction solar cells are presented. Relations between processing, materials properties and device performance were studied. The analysis of these solar cells explains how minority carrier recombination at the interface and at grain boundaries can be reduced by doping of windows and absorber layers, such as in high efficiency CdTe and $CuInSe_2$ based solar cells. The additional geometric dimension introduced by the polycrystallinity must be taken into consideration. The solar cells are limited by the diode current, caused by recombination in the space charge region. J-V characteristics of $CuInSe_2$/(CdZn)S cells were analyzed. Current-voltage and spectral response measurements were also made on high efficiency CdTe/CdS thin film solar cells prepared by vacuum evaporation. Cu-In bilayers were reacted with Se and H_2Se gas to form $CuInSe_2$ films; the reaction pathways and the precursor were studied. Several approaches to fabrication of these thin film solar cells in a superstrate configuration were explored. A self-consistent picture of the effects of processing on the evolution of CdTe cells was developed.

373 (OUP–92-17) **Hydrogen production from solar energy: A review of photolysis.** Bergene, T. Oslo Univ. (Norway). Fysisk Inst. Jun 1992. 25p. Order Number DE93721642. Source: OSTI; NTIS.

Direct splitting of water into hydrogen and oxygen by ordinary sunlight seems impossible because water is transparent to sunlight in the visible region. However, splitting is known to occur when a semiconductor act as a catalyst in the meaning that it transfers energy from the photons absorbed by it to an electrolyte, a process referred to as photolysis. In this review, the physical principles of photolysis, using semiconducting electrodes as catalysts, are summarized. An analysis of efficiencies is given, and some efficiency-determining parameters are analyzed. In addition, the mechanisms of charge-transfer between the semiconductor and the electrolyte are reviewed. Some paths for future research, both experimental and theoretical are outlined. 22 refs., 3 figs.

1406 Photovoltaic Power Systems

374 (ETDE-IT–92-89) **Intermediate-sized photovoltaic plants to supply power villages: Future developments.** Previ, A. Ente Nazionale per l'Energia Elettrica, Milan (Italy). Centro di Ricerca Elettrica. 1990. 3p. Order Number DE93729449. Source: OSTI; NTIS (US Sales Only); INIS.

The activity promoted by the European Communities, aimed at demonstrating the feasibility of supplying both active and passive power distribution networks by means of photovoltaic plants (PV) has been highly successful. The PV plants at Aghia Roumeli, Pellworm, Rondulinu, and Vulcano are stand-alone plants that can supply small isolated communities. The plant at Kytnos supplies power to the grid with the help of electrochemical storage; the plants at Pellworm, and Vulcano can also supply power to the grid, the first with e.c. storage and the second without such storage. This paper gives an overview of the activity promoted by the Communities EEC-DGXII research group aimed at demonstrating the feasibility of supplying both active and passive power distribution networks by means of PV plants. Possible improvements of the power conditioning sub-system are presented.

375 (EUR–14038) **Photovoltaic demonstration projects.** Kaut, W. (Commission of the European Communities, Brussels (Belgium)); Gillett, W.B.; Hacker, R.J. Commission of the European Communities, Luxembourg (Luxembourg). 1991. 220p. Source: OSTI; NTIS (US Sales Only).

This publication, comprising the proceedings of the fifth contractor's meeting organized by the Commission of the European Communities, Directorate-General for Energy, provides an overview of the photovoltaic demonstration projects which have been supported in the framework of the energy demonstration programme since 1983. It includes reports by each of the contractors who submitted proposals in 1987 and 1988, describing progress within their projects. Projects accepted from earlier calls for proposals and not yet completed were reviewed by a rapporteur and are discussed in the summary section. The results of the performance monitoring of all projects and the lessons drawn from the practical experience of the projects are also presented in the summaries and conclusions. Contractors whose projects were submitted in 1989 were also present at the meeting and contributed to the reported discussions. This proceeding is divided into four sessions (General, Housing, technical presentations, other applications) and 24 papers are offered.

376 (NEI-DK–978) **Description and testing of photovoltaic refrigerator for vaccine storage and icepack freezing.** Gydesen, A.; Schjaer-Jacobsen, J. Danmarks Tekniske Hoejskole, Lyngby (Denmark). Fysisk Lab. 3. May 1992 142p. Order Number DE93721450. Source: OSTI; NTIS.

The purpose of the project is the design, building and testing of a photovoltaic-powered refrigerator. The refrigerator is intended for vaccine storage and ice-pack freezing and is designed to comply with specifications from the World Health Organization (WHO). In order to reduce the required size of the battery and solar panels, and at the same time accomplish a long expected battery life, some unique features are included. The system employs an ice storage that replaces part of the traditional battery storage; the energy consumption is kept low; temperature control and battery charging are handled by a microprocessor, following a strategy that as far as possible avoids discharging the battery; an electrical heater is used (on rare occasions) to keep the vaccine compartment temperature above the lower limit. Three prototypes have been built and tested. The test results show that the system functions as intended, using a relatively small solar panel and one relatively small maintenance free battery. It easily maintains the vaccine temperature within the required range and freezes 2 kg ice per day at a reasonable solar radiation. The battery is virtually not discharged. Some problems were encountered during the test period, such as a burnt-out transistor in one of the controllers, a bad thermistor temperature sensor and a loose connection in one of the refrigerators, and various malfunctions of the data logging equipmet. However, the problems concerning refrigerators are considered to be easily avoidable in mass-produced equipment. (Author) (13 refs.).

1407 Solar Thermal Power Systems

Refer also to citation(s) 388

377 (PNL-SA–20025) **Monte Carlo simulation of radiation heat transfer in arrays of fixed discrete surfaces using cell-to-cell photon transport.** Drost, M.K. (Pacific Northwest Lab., Richland, WA (United States)); Welty, J.R. Pacific Northwest Lab., Richland, WA (United States). Aug 1992. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-920804–26: American Society of Mechanical Engineers national heat transfer conference and exposition, San

Diego, CA (United States), 9-12 Aug 1992). Order Number DE93001301. Source: OSTI; NTIS; GPO Dep.

Radiation heat transfer in an array of fixed discrete surfaces is an important problem that is particularly difficult to analyze because of the nonhomogeneous and anisotropic optical properties involved. This article presents an efficient Monte Carlo method for evaluating radiation heat transfer in arrays of fixed discrete surfaces. This Monte Carlo model has been optimized to take advantage of the regular arrangement of surfaces often encountered in these arrays. Monte Carlo model predictions have been compared with analytical and experimental results.

378 (SAND–92-1031C) **An overview of current activities at the National Solar Thermal Test Facility.** Cameron, C.P.; Klimas, P.C. Sandia National Labs., Albuquerque, NM (United States). [1992]. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-920938–1: 6. international symposium on solar thermal concentrating technologies, Mojacar (Spain), 28 Sep - 2 oct 1992). Order Number DE92041160. Source: OSTI; NTIS; GPO Dep.

This paper is a description of the United States Department of Energy's National Solar Thermal Test Facility, highlighting current test programs. In the central receiver area, research underway supports commercialization of molten nitrate salt technology, including receivers, thermal energy transport, and corrosion experiments. Concentrator research includes large-area, glass-metal heliostats and stretched-membrane heliostats and dishes. Test activities in support of dish-Stirling systems with reflux receivers are described. Research on parabolic troughs includes characterization of several receiver configurations. Other test facility activities include solar detoxification experiments, design assistance testing of commercially-available solar hardware, and non-DOE-funded work, including thermal exposure tests and. testing of volumetric and PV central receiver concepts.

1409 Solar Thermal Utilization

Refer also to citation(s) 79, 384, 851, 856

379 (DOE/CH/10205–T2) **Passive cooling with solar updraft and evaporative downdraft chimneys: Interim report, June 15, 1984–March 1, 1985.** Mignon, G.V.; Cunningham, W.A.; Thompson, T.L. Arizona Univ., Tucson, AZ (United States). Environmental Research Lab. [1985]. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-84CH10205. Order Number DE93001746. Source: OSTI; NTIS; GPO Dep.

Computer models have been developed to describe the operation of both solar updraft and evaporative downdraft chimneys. Design studies are being conducted at the present time to use the towers for cooling an experimental, well instrumented, structure to study passive cooling in residential buildings. (MHR)

380 (DOE/CH/10205–T3) **Establish feasibility for providing passive cooling with solar updraft and evaporative downdraft chimneys: Final report, June 15, 1984–December 31, 1987.** Cunningham, W.A.; Mignon, G.V.; Thompson, T.L. Arizona Univ., Tucson, AZ (United States). Environmental Research Lab. [1987]. 112p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-84CH10205. Order Number DE93001745. Source: OSTI; NTIS; GPO Dep.

Natural draft towers can be used for cooling and ventilating structures. From an operational perspective, the downdraft evaporatively cooled tower is preferred for a dry climate. Solar chimneys, when used alone, tend to require an excessively large solar collector area when appreciable quantities of air must be moved. When used in combination with a downdraft tower, the roof and attic of buildings may assist the solar chimney and their use becomes more attractive. Both a frame building and a greenhouse were successfully cooled during this program. The economics of the downdraft tower compare favorably with conventional evaporative cooling for some application.

381 (DOE/CH/10205–T5) **Establishing feasibility for providing passive cooling with solar updraft and evaporative downdraft chimneys: Progress report, October 1985–February 1986.** Cunningham, W.A.; Mignon, G.V. Arizona Univ., Tucson, AZ (United States). [1986]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-84CH10205. Order Number DE93003062. Source: OSTI; NTIS; GPO Dep.

At the present time all experimental towers (chimneys) are completed and operating. This consists of both a solar updraft and a natural-evaporative downdraft tower retrofitted to an existing residence structure and a greenhouse. The residential, experimental, natural-draft cooling system was completed in May, 1985, and five months of summer data on a Hewlet Packard 85 data acquisition computer with a digital voltmeter were acquired. The cooling tower and solar chimney on the experimental greenhouse became operational in September of 1985. A conceptual drawing of both the greenhouse and the residence natural-draft towers is included in the appendix along with the September 85 progress report.

382 (DOE/CH/10205–T6) **Establishing feasibility for providing passive cooling with solar updraft and evaporative downdraft chimneys: Progress report, March 1985–September 1985.** Cunningham, W.A.; Migon, G.V. Arizona Univ., Tucson, AZ (United States). [1985]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-84CH10205. Order Number DE93003063. Source: OSTI; NTIS; GPO Dep.

The solar updraft and a natural evaporative downdraft tower built onto an existing residence structure and a greenhouse were completed and operating. Performance data for the hottest days of June, July, and August, 1985 are included. (MHR)

383 (NEI-DK–952) **Environmental and energy analysis of the plus energy house: Project using tsbi3 dynamic simulation program.** Janak, M. Nordvestjysk Folkecenter for Vedvarende Energi, Hurup (Denmark). Jun 1992 30p. Contract SE/00280/89/DK. Order Number DE93721384. Source: OSTI; NTIS.

The building investigated was to be used for offices combined with a large greenhouse. The building was to be used as a source of heat production with sale of surplus energy, the aim was to save on energy consumption in the greenhouse and to save on the cost of living in the house by using a climate shield. The construction of the building is described and illustrated with diagrams. A daylighting analysis was carried out using the OSV1 computer programme developed at the Slovak Technical University. The environmental and energy analysis were carried out using the tsbi3 dynamic simulation programme. Here the aim was to design the heating and dehumidification system, suggest the operation mode for a beadwall system and check comfort conditions. The passive solar features, and heating and cooling systems are described and the results of the energy and environmental analysis are presented. It was concluded that the beadwall system gave rise to direct passive solar energy gains together with its shading, ventilation and dehumidification/cooling system. (AB).

1410 Solar Collectors and Concentrators

Refer also to citation(s) 378

384 (DOE/SF/16345–5) **Open-cycle absorption solar cooling: Natural convection heat and mass transfer from falling films in vertical channels: Final report.** Buck, G.A.; Wood, B.D. Arizona State Univ., Tempe, AZ (United States). Jun 1992. 315p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG03-86SF16345. Order Number DE92040999. Source: OSTI; NTIS; GPO Dep.

In the design of solar collector/regenerators for use in open cycle absorption refrigeration (OCAR) units, the problem of predicting evaporation mtes and solution temperatures is of paramount importance in determining overall cycle performance. The governing equations for natural convection flow in a vertical channel bounded by a heated falling film (simulating a glazed collector/regenerator) were solved using several different finite difference techniques. The numerical results were validated against existing experimental and numerical results for simplified boundary conditions. The appropriate nondimensionalization for the falling film boundary condition was established, ostensibly for the first time, and a parametric study for an air-water vapor mixture has been presented. Curve fits to the numerical results were determined for engineering design applications. To further confirm the validity of the numerical solutions,

an experimental apparatus was constructed using electric resistance heat to simulate the constant heat flux of the solar source. Water was introduced at the top of this heated vertical surface at various flow rates and under various supplied heat fluxes, and a natural convection channel flow generated between the heated falling film and a parallel, plexiglas surface. Film temperatures and moist air velocity profiles were measured at various streamwise (vertical) locations for comparison with the numerical results.

385 (EUR–13469) **Iso solar thermal standards studies to improve technical and scientific information for the finalization of performance test procedures.** Gilliaert, D. (Commission of the European Communities, Ispra (Italy). Joint Research Centre); Tebaldi, P.; Morrison, G. Commission of the European Communities, Luxembourg (Luxembourg). 1992. 90p. Source: OSTI; NTIS (US Sales Only).

During a Visiting Scientist programme in 1990 at the Joint Research Centre, work was carried out to develop documentation and technical support on solar collector and solar water heater test methods for submission to the International Standards Organisation (ISO). Investigations covered the measurement of long wave atmospheric radiation for unglazed solar collector characterization, thermal performance test procedures for unglazed solar collectors, and outdoor testing to determine the effects of load pattern and auxiliary boosting.

386 (EUR–13907) **Estimation of the corrosion risk of solar collectors. A five-year weathering experiment in industrial and rural areas.** Bauch, R. (Commission of the European Communities, Ispra (Italy). Joint Research Centre); Brovelli, M.; Laghi, F.; Weisgerber, P. Commission of the European Communities, Luxembourg (Luxembourg). 1992. 56p. Source: OSTI; NTIS (US Sales Only).

The weathering experiment, with five solar collector models from different manufacturers, chosen for their various construction materials, and arranged in two identically equipped test fields operating under simulated working conditions, at one site with industrial and one with rural environment, was concluded in 1988. The environmental variables which are significant for thermal charge of the collectors such as solar irradiance and for the corrosion risk such as relative air humidity and gaseous sulfur dioxide concentrations were measured and recorded during the last two and a half years of the weathering experiment. Air Suspended particulate matter extracted during that time from the sample air stream by dust filters was also analyzed and the mean concentrations of particulate bound sulfur estimated. The evaluation of these data revealed, that the average values of the concentration of gaseous sulfur dioxide at the industrial site were higher than those of the rural site by a factor of about 1.7. The same ratio between those two sites was also found for the average values of the concentration of sulfur bound to air suspended particulate matter. Greater corrosion effects were indeed observed on the industrial site, but they were not severe enough for as to expect serious damages on prolonged exposure. Comparing the corrosion effects with those obtained from the usual 'moist SO_2 tests' confirmed our initial suspicion, that the latter are much too aggressive for predictions of resistance against atmospheric corrosion, with the exception of collector installations in some rather rare situations of great corrosion risk. 9 refs., 5 figs., 5 tabs., 5 annexes.

387 (SAND–92-7001) **Development of a commercial photovoltaic concentrator module.** Saifee, S.T. (Solar Kinetics, Inc., Dallas, TX (United States)); Hutchison, G. Sandia National Labs., Albuquerque, NM (United States); Solar Kinetics, Inc., Dallas, TX (United States). Sep 1992. 73p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93002594. Source: OSTI; NTIS; GPO Dep.

The ojective of this work was to develop the design and prototype of a commercial high-concentration photovoltaic (PV) module. The design is for a 282-sun point-focus concentrating module. Most of the components, subassemblies, and design features incorporate simplifications and ease of manufacturing. The Solar Kinetics, Inc. (SKI) module is designed to incorporate high-efficiency, single-crystal silicon PV cells. The housing is made with aluminum laminated for voltage stand-off and simultaneously providing high thermal conductivity. The Fresnel lens injection molded by American Optical (AO) as singles. The cell assembly consists of a copper heat spreader, a photovoltaic cell soldered, a top and bottom contact, and a reflective secondary optical element (SOE). The cell assemblies passed all of the initial electrical characterization and high-potential tests. Under environmental cycling, the only bond that failed was the PV cell-to-heat spreader interface. The other components (top contact, bottom contact, SOE) passed all the environmental cycling tests. The cell assemblies were designed to be mounted onto the receiver section with a thermally conductive RTV. This geometry was subjected to environmental testing. There was no delamination of this bond nor was there electrical breakdown when the assemblies were subjected to the hi-pot test. A mock module was fabricated for environmental evaluation. This module was subjected to the humidity/freeze cycling to assess the performance of the lens mounting design. This module was also subjected to the rain test after the humidity/freeze cycling and checked for water leaks. The lens showed small displacement from its original position after the environmental cycling. One tablespoon of water did collect inside the module.

388 (SAND–92-7009) **Wind load design methods for ground-based heliostats and parabolic dish collectors.** Peterka, J.A. (Colorado State Univ., Fort Collins, CO (United States). Fluid Dynamics and Diffusion Lab.); Derickson, R.G. Sandia National Labs., Albuquerque, NM (United States). Sep 1992. 80p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93002737. Source: OSTI; NTIS; GPO Dep.

The purpose of this design method is to define wind loads on flat heliostat and parabolic dish collectors in a simplified form. Wind loads are defined for both mean and peak loads accounting for the protective influence of upwind collectors, wind protective fences, or other wind-blockage elements. The method used to define wind loads was to generalize wind load data obtained during tests on model collectors, heliostats or parabolic dishes, placed in a modeled atmospheric wind in a boundary-layer wind-tunnel at Colorado State University. For both heliostats and parabolic dishes, loads are reported for solitary collectors and for collectors as elements of a field. All collectors were solid with negligible porosity; thus the effects of porosity in the collectors is not addressed.

389 **Ambient radiant energy concentrator.** Horsley, P.B. 4 Jul 1992. Filed date 3 Jan 1991. Canada Patent patent application 2033526. 7p. Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN.

In a solar energy concentrator that can accept radiant energy from all directions, an elongated plane mirror faces directly towards the center of the bowl of an elongated mirror that in section has a parabolic profile. With these two components, the incoming radial converging pattern of rays is changed into a new pattern in which all of the rays are turned parallel and concentrated together. The concentration of parallel rays then enters a narrow slot in the center of the parabolic mirror or in the center of the plane mirror where the radiant energy impinges on a thermal element. The heated element is a blackened metal tube containing a circulatory fluid. The heated thermal element has a cylindrical jacket with a mirrored interior surface to reflect back and prevent the escape of collected energy. A small slot in the jacket permits the narrow beam of concentrated radiant energy to enter and impinge on the blackened thermal element. The temperature of the heated element is elevated sufficiently by the radiation concentrator to boil the enclosed fluid. The pressurized vapor from the fluid is then directed through a turbine to generate electric power, or is used for heating. Four of the radiant energy concentrators can be supported in a tower arrangement to collect radiation from all directions. 5 figs.

1440 Legislation and Regulations

390 (EUR–13518) **Guidelines for the technical follow-up of solar thermal plants.** Colombo, R. (Commission of the European Communities, Ispra (Italy). Joint Research Centre); Gilliaert, D.; Landabaso, A. Commission of the European Communities, Luxembourg (Luxembourg). 1992. 59p. Source: OSTI; NTIS (US Sales Only).

This document describes the various ways in which contractors of the CEC DG XVII solar thermal demonstration projects should provide technical information to the Commission. The four major communications channels are SESAME data sheets, interim technical reports, final technical reports and technical visits, the requirements for each of which are explained in detail.

15 GEOTHERMAL ENERGY

391 (CONF-920378–, pp. 187-190) **Technology transfer, reaching the market for geopressured-geothermal resources.** Negus-de Wys, J. (Idaho National Engineering Lab., Idaho Falls (United States)). USDOE Assistant Secretary for Conservation and Renewable Energy, Washington, DC (United States). Geothermal Div. [1992]. DOE Contract AC07-76ID01570. From Geothermal energy program review: geothermal energy and the utility market–the opportunities and challenges for expanding geothermal energy in a competitive supply market; San Francisco, CA (United States); 24-26 Mar 1992. In *Geothermal energy and the utility market – the opportunities and challenges for expanding geothermal energy in a competitive supply market: Proceedings. Geothermal Program Review X.* 230p. Order Number DE92019090. Source: OSTI; NTIS.

Technology transfer to the industrial sector for geopressured-geothermal technology has included diverse strategies, with successes and obstacles or roadblocks. Strategy categories include the following: feasibility studies and reports, consortium activities and proceedings, the Geothermal Resource Council, national and international meetings of the American Association of Petroleum Geologists, other societal and organizational meetings and conferences, Department of Energy solicitation of interest in the commerce Business Daily, industry peer review panels, and the Secretary's Technology Initiative. All of the above strategies contribute to technology transfer and are needed in some combination for the desired success. The most successful strategy activities for bringing in the interest of the largest number of industries and the independents are the consortium meetings, one-on-one telephone calling, and consortium proceedings with information service followup. The most successful strategy activities for bringing in the interest and participation of majors are national and international peer reviewed papers at internationally recognized industry-related society meetings, and on-call presentations to specific companies. The numerical results of the activities reflecting four years of technology transfer following the 15 year lead in the early phases of the geopressured-geothermal program under the leadership of Dr. Myron Dorfman, reflect a dynamic surveying of what works in technology transfer with industry in the area of geopressured-geothermal resources. The identified obstacles can be removed and future efforts can benefit by this cataloging and discussion of results.

1502 Geology and Hydrology of Geothermal Systems

392 (CONF-920378–, pp. 57-63) **TETRAD reservoir simulation.** Shook, M. (Idaho National Engineering Lab., Idaho Falls (United States)). USDOE Assistant Secretary for Conservation and Renewable Energy, Washington, DC (United States). Geothermal Div. [1992]. DOE Contract AC07-76ID01570. From Geothermal energy program review: geothermal energy and the utility market–the opportunities and challenges for expanding geothermal energy in a competitive supply market; San Francisco, CA (United States); 24-26 Mar 1992. In *Geothermal energy and the utility market – the opportunities and challenges for expanding geothermal energy in a competitive supply market: Proceedings. Geothermal Program Review X.* 230p. Order Number DE92019090. Source: OSTI; NTIS.

The complexities of operating a geothermal field make it useful to incorporate reservoir simulation in the suite of tools available for the management of the resource. The criteria used in selecting a useful numerical simulator include such issues as ease of use, input/output options, and continued user support. The simulator must be validated to ensure that it yields correct results. Having been validated, the simulator can then be used to improve the predictive capabilities required to optimize geothermal resource management. The simulator TETRAD is used by INEL's Geothermal Reservoir Technology Program, based on the selection criteria noted above. Code validation was achieved through the solution of the Stanford Geothermal Problem Set. TETRAD was then used in a parametric evaluation of reservoir properties. The parametric study demonstrates the importance of various input parameters to accurate simulation. Parameters investigated include reservoir structure, relative permeability- and capillary pressure-saturation relationships, and dual porosity parameters. A field scale study is also presented that shows the importance of considering reservoir structure and the location of other wells in siting new wells.

393 (CONF-920378–, pp. 135-141) **A model for large-scale thermal convection in the Long Valley geothermal region.** Hickox, C.E. (Sandia National Labs., Albuquerque, NM (United States)); Dunn, J.C. USDOE Assistant Secretary for Conservation and Renewable Energy, Washington, DC (United States). Geothermal Div. [1992]. DOE Contract AC04-76DP00789. From Geothermal energy program review: geothermal energy and the utility market–the opportunities and challenges for expanding geothermal energy in a competitive supply market; San Francisco, CA (United States); 24-26 Mar 1992. In *Geothermal energy and the utility market – the opportunities and challenges for expanding geothermal energy in a competitive supply market: Proceedings. Geothermal Program Review X.* 230p. Order Number DE92019090. Source: OSTI; NTIS.

A numerical simulation is presented for a simplified model of the Long Valley geothermal system in order to elucidate the nature of the large-scale thermal structure within the system and to assess implications for the drilling program currently underway in the region. The two-dimensional model consists of three horizontal layers, the upper two of which are porous and saturated with a single phase fluid. The system is limited in horizontal extent and heated uniformly from below. An associated planar, natural convective flow is thus produced. The results of the simulation indicate the possibility of wide variations in vertical temperature profiles for the model system, depending on the locations of measurements relative to the convective cells within the layered medium. Thus it can be inferred that, during the early stages of drilling, the vertical temperature distribution may not be a reliable indicator of the presence or absence of the relatively shallow magma body which has been predicted to underlie the geothermal region.

394 (CONF-920378–, pp. 177-182) **Reservoir modeling and prediction at Pleasant Bayou geopressured-geothermal reservoir.** Shook, M. (Idaho National Engineering Lab., Idaho Falls (United States)). USDOE Assistant Secretary for Conservation and Renewable Energy, Washington, DC (United States). Geothermal Div. [1992]. DOE Contract AC07-76ID01570. From Geothermal energy program review: geothermal energy and the utility market–the opportunities and challenges for expanding geothermal energy in a competitive supply market; San Francisco, CA (United States); 24-26 Mar 1992. In *Geothermal energy and the utility market – the opportunities and challenges for expanding geothermal energy in a competitive supply market: Proceedings. Geothermal Program Review X.* 230p. Order Number DE92019090. Source: OSTI; NTIS.

Modeling and prediction of geopressured-geothermal reservoirs is an excellent example of an engineering problem that can be solved through many different means. The problem may be approached from a purely numerical viewpoint, where a successful history match demonstrates the validity of the reservoir model, or from an analytical point of view. Each method has its own inherent limitations and weaknesses. Such limitations can be minimized by using some combination of both numerical and analytical methods, taking advantage of the strengths of each without the attendant weaknesses. This paper describes a combined numerical/analytical approach to reservoir engineering at the Pleasant Bayou geopressured-geothermal reservoir. A reservoir description had previously been developed, through which a successful history match was performed. Certain details of the reservoir can also be obtained through analysis of pressure and flow transients; these can then be used to constrain the numerical model. Methods for extracting such reservoir data are discussed, and the manner in which they can be used as constraints in the numerical models are presented.

395 (LBL–32139) **LBL research on The Geysers: Conceptual models, simulation and monitoring studies.** Bodvarsson, G.S.; Lippmann, M.J.; Majer, E.L.; Pruess, K. Lawrence Berkeley Lab., CA (United States). Mar 1992. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-920378–10: Geothermal energy program review: geothermal energy and the utility market–the opportunities and challenges for expanding geothermal energy in a competitive supply market, San Francisco, CA (United States), 24-26 Mar 1992). Order Number DE93000628. Source: OSTI; NTIS; GPO Dep.

As part of The Geysers research activities of DOE's Geothermal Reservoir Technology Program, LBL, in close co-operation with industry, is performing fundamental and applied studies of vapor-dominated geothermal systems. These studies include the development of new methods for evaluating cold water injection, monitoring of the seismic activity in The Geysers associated with injection and production, interpretation of pressure and geochemical changes measured during well tests and long-term production and injection operations, and improvement of existing models of the geothermal system. A review is given of the latest results of DOE-sponsored LBL reservoir engineering and seismic studies relevant to The Geysers.

1503 Geothermal Exploration and Exploration Technology

Refer also to citation(s) 400

396 (CONF-920378–, pp. 89-91) **Downhole memory-logging tools.** Lysne, P. (Sandia National Labs., Albuquerque, NM (United States)). USDOE Assistant Secretary for Conservation and Renewable Energy, Washington, DC (United States). Geothermal Div. [1992]. DOE Contract AC04-76DP00789. From Geothermal energy program review: geothermal energy and the utility market–the opportunities and challenges for expanding geothermal energy in a competitive supply market; San Francisco, CA (United States); 24-26 Mar 1992. In *Geothermal energy and the utility market – the opportunities and challenges for expanding geothermal energy in a competitive supply market: Proceedings. Geothermal Program Review X.* 230p. Order Number DE92019090. Source: OSTI; NTIS.

Logging technologies developed for hydrocarbon resource evaluation have not migrated into geothermal applications even though data so obtained would strengthen reservoir characterization efforts. Two causative issues have impeded progress: (1) there is a general lack of vetted, high-temperature instrumentation, and (2) the interpretation of log data generated in a geothermal formation is in its infancy. Memory-logging tools provide a path around the first obstacle by providing quality data at a low cost. These tools feature on-board computers that process and store data, and newer systems may be programmed to make decisions. Since memory tools are completely self-contained, they are readily deployed using the slick line found on most drilling locations. They have proven to be rugged, and a minimum training program is required for operator personnel. Present tools measure properties such as temperature and pressure, and the development of noise, deviation, and fluid conductivity logs based on existing hardware is relatively easy. A more complex geochemical tool aimed at a quantitative analysis of potassium, uranium and thorium will be available in about one year, and it is expandable into all nuclear measurements common in the hydrocarbon industry. A second tool designed to sample fluids at conditions exceeding 400 C is in the proposal stage. Partnerships are being formed between the geothermal industry, scientific drilling programs, and the national laboratories to define and develop inversion algorithms relating raw tool data to more pertinent information.

397 (LA–12382-MS) **Closed-loop flow test Miravalles Geothermal Field well log results.** Dennis, B.; Eden, G.; Lawton, R. Los Alamos National Lab., NM (United States). [1992]. 30p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE93001360. Source: OSTI; NTIS; GPO Dep.

The Instituto Costarricense de Electricidad (ICE) conducted a closed-loop flow test in the Miravalles Geothermal Field. The closed-loop test was started in May and ran through August of 1990. The effluent from the production well PG-11 was carried by a pipeline through a monitor station to the injection well PG-2. Before starting the long-term flow test in May, cold-water injection experiments were performed in each well to determine the pressure and temperature response. A series of downhole measurements were made in each well to obtain background information. The downhole measurements were repeated in August just before terminating the flow test to evaluate the results.

1505 Economic, Industrial, and Business Aspects

398 (CONF-920378–, pp. 7-10) **Geothermal energy market in southern California: Past, present and future.** Budhraja, V.S. (Southern California Edison, Rosemead (United States)). USDOE Assistant Secretary for Conservation and Renewable Energy, Washington, DC (United States). Geothermal Div. [1992]. From Geothermal energy program review: geothermal energy and the utility market–the opportunities and challenges for expanding geothermal energy in a competitive supply market; San Francisco, CA (United States); 24-26 Mar 1992. In *Geothermal energy and the utility market – the opportunities and challenges for expanding geothermal energy in a competitive supply market: Proceedings. Geothermal Program Review X.* 230p. Order Number DE92019090. Source: OSTI; NTIS.

The author discusses the outlook for the geothermal industry, framing it within Southern California Edison's experience with geothermal and other alternative/renewable energy sources. Edison now has 633 MW of geothermal on its system, representing 3.2% of their capacity. They also use more wind and solar energy for power generation than any other utility. The paper discusses the cost of geothermal power, the competition it faces, and what needs to be done to make geothermal energy more cost competitive with cheaper fossil fuels.

1506 Environmental Aspects

399 (DOE/NV/10425–T12) **Geopressured-geothermal well activities in Louisiana: Annual report, 1 January 1991–31 December 1991.** John, C.J. Louisiana Geological Survey, Baton Rouge, LA (United States). Oct 1992. 128p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC07-85NV10425. Order Number DE93002865. Source: OSTI; NTIS; INIS; GPO Dep.

Since September 1978, microseismic networks have operated continuously around US Department of Energy (DOE) geopressured-geothermal well sites to monitor any microearthquake activity in the well vicinity. Microseismic monitoring is necessary before flow testing at a well site to establish the level of local background seismicity. Once flow testing has begun, well development may affect ground elevations and/or may activate growth faults, which are characteristic of the coastal region of southern Louisiana and southeastern Texas where these geopressured-geothermal wells are located. The microseismic networks are designed to detest small-scale local earthquakes indicative of such fault activation. Even after flow testing has ceased, monitoring continues to assess any microearthquake activity delayed by the time dependence of stress migration within the earth. Current monitoring shows no microseismicity in the geopressured-geothermal prospect areas before, during, or after flow testing.

1509 Geothermal Engineering

Refer also to citation(s) 105, 392, 394, 395

400 (CONF-920378–, pp. 29-30) **Reservoir technology.** Renner, J.L. (Idaho National Engineering Lab., Idaho Falls (United States)). USDOE Assistant Secretary for Conservation and Renewable Energy, Washington, DC (United States). Geothermal Div. [1992]. DOE Contract AC07-76ID01570. From Geothermal energy program review: geothermal energy and the utility market–the opportunities and challenges for expanding geothermal energy in a competitive supply market; San Francisco, CA (United States); 24-26 Mar 1992. In *Geothermal energy and the utility market – the opportunities and challenges for expanding geothermal energy in a*

competitive supply market: Proceedings. Geothermal Program Review X. 230p. Order Number DE92019090. Source: OSTI; NTIS.

The reservoir technology program supports the utilization of geothermal resources through development and verification of new earth science technologies for: exploration, fluid production and injection, and prediction of reservoir lifetimes. A two-fold strategy of conducting DOE-sponsored research to meet higher-risk, longer-term needs and cost-shared research with industry in areas of greatest current need is utilized to maximize the benefit of the program to the geothermal industry. Research at The Geysers geothermal field has received major emphasis in the past three years. The paper summarizes this research. Two small programs support the understanding of the chemical evolution of geothermal systems and changes in gravimetric pattern of geothermal systems. The reservoir technology program has recently initiated a program directed toward increasing the use of the low- and moderate-temperature geothermal resources of the US. The program will update the existing inventories of hydrothermal resources and provide outreach to potential users of geothermal resources, particularly users of geothermal heat pumps. The Geothermal Technology Organization and DOE have completed studies of the applicability of advanced seismic techniques to monitor injection and productivity enhancement at The Geysers steam field, and validation of vapor phase tracers and tracer return data from an industry tracer-injection test in the southeast Geysers.

401 (CONF-920378–, pp. 31-36) **LBL research on The Geysers: Conceptual models, simulation and monitoring studies.** Bodvarsson, G.S. (Lawrence Berkeley Lab., CA (United States)); Lippmann, M.J.; Majer, E.L.; Pruess, K. USDOE Assistant Secretary for Conservation and Renewable Energy, Washington, DC (United States). Geothermal Div. [1992]. DOE Contract AC03-76SF00098. From Geothermal energy program review: geothermal energy and the utility market–the opportunities and challenges for expanding geothermal energy in a competitive supply market; San Francisco, CA (United States); 24-26 Mar 1992. In *Geothermal energy and the utility market – the opportunities and challenges for expanding geothermal energy in a competitive supply market: Proceedings. Geothermal Program Review X.* 230p. Order Number DE92019090. Source: OSTI; NTIS.

As part of The Geysers research activities of DOE's Geothermal Reservoir Technology Program, LBL, in close cooperation with industry, is performing fundamental and applied studies of vapor-dominated geothermal systems. These studies include the development of new methods for evaluating cold water injection, monitoring of the seismic activity in The Geysers associated with injection and production, interpretation of pressure and geochemical changes measured during well tests and long-term production and injection operations, and improvement of existing models of the geothermal system. A review is given of the latest results of DOE-sponsored LBL reservoir engineering and seismic studies relevant to The Geysers.

402 (CONF-920378–, pp. 81-88) **Lost circulation technology development status.** Glowka, D.A. (Sandia National Labs., Albuquerque, NM (United States)); Schafer, D.M.; Loeppke, G.E.; Scott, D.D.; Wernig, M.D.; Wright, E.K. USDOE Assistant Secretary for Conservation and Renewable Energy, Washington, DC (United States). Geothermal Div. [1992]. DOE Contract AC04-76DP00789. From Geothermal energy program review: geothermal energy and the utility market–the opportunities and challenges for expanding geothermal energy in a competitive supply market; San Francisco, CA (United States); 24-26 Mar 1992. In *Geothermal energy and the utility market – the opportunities and challenges for expanding geothermal energy in a competitive supply market: Proceedings. Geothermal Program Review X.* 230p. Order Number DE92019090. Source: OSTI; NTIS.

Lost circulation is the loss of drilling fluid from the wellbore to fractures or pores in the rock formation. In geothermal drilling, lost circulation is often a serious problem that contributes greatly to the cost of the average geothermal well. The Lost Circulation Technology Development Program is sponsored at Sandia National laboratories by the US Department of energy. The goal of the program is to reduce lost circulation costs by 30-50% through the development of mitigation and characterization technology. This paper describes the technical progress made in this program during the period April, 1991-March, 1992.

403 (DOE/ID/13040–T11) **Data acquisition for low-temperature geothermal well tests and long-term monitoring: Final report.** Lienau, P.J. Oregon Inst. of Tech., Klamath Falls, OR (United States). Geo-Heat Center. Sep 1992. 44p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG07-90ID13040. Order Number DE93000387. Source: OSTI; NTIS; GPO Dep.

Groundwater monitoring is an essential part of the development of a low-temperature geothermal field for production and injection wells. State water resource and environmental departments are requiring both geothermal well testing and long-term monitoring as a part of the permitting process for geothermal developments. This report covers water-level measurement methods, instruments used for well testing, geochemical sampling, examples of data acquisition and regulatory mandates on groundwater monitoring.

404 (LBL–32357) **Boiling and condensation processes in the Cerro Prieto beta reservoir under exploitation.** Truesdell, A. (Truesdell (Alfred), Menlo Park, CA (United States)); Manon, A.; Quijano, L.; Coplen, T.; Lippmann, M. Lawrence Berkeley Lab., CA (United States). Jan 1992. 11p. Sponsored by USDOE, Washington, DC (United States); Geological Survey, Reston, VA (United States). DOE Contract AC03-76SF00098. (CONF-920119–4: 17. workshop on geothermal reservoir engineering, Stanford, CA (United States), 29-31 Jan 1992). Order Number DE93000630. Source: OSTI; NTIS; GPO Dep.

The deep Cerro Prieto (Baja California, Mexico) beta reservoir is offset vertically by the southwest-northeast trending, normal H fault. Under exploitation pressures in the upthrown block have decreased strongly resulting in boiling and high-enthalpy production fluids. Significant differences in fluid chemical and isotopic compositions are observed in the two parts of the reservoir and particularly in an anomalous zone associated with the H fault. These differences result from intense boiling and adiabatic steam condensation, as well as from leakage of overlying cooler water along the fault.

1520 Geothermal Data and Theory

Refer also to citation(s) 404

16 TIDAL AND WAVE POWER

1601 Resources and Availability

405 (ETDE-IT–92-76) **Wave motion along Italian coasts: ENEL study.** Ente Nazionale per l'Energia Elettrica, Milan (Italy). Mar 1992. 60p. (In Italian). Order Number DE93729397. Source: OSTI; NTIS (US Sales Only).

This paper reports the results of a 1991 ENEL (Italian Electricity Board) monitoring campaign to establish wave motion characteristics along the coastline at Brindisi. The 1991 physical-dynamic data (maximum and average wave heights, date and frequency of categorized wave action), presented through a series of tables and graphs, complement statistical data obtained over several years of monitoring, starting from 1976.

1607 Tidal Power Plants

Refer also to citation(s) 363

17 WIND ENERGY

406 (NEI-FI–168) **Finnwind'90: Presentations.** Finnish Wind Power Association, Espoo (Finland). 1990. 120p. (CONF-9010521–: FINNWIND'90: conference on wind power in Finland, Pori (Finland), 19-20 Oct 1990). Order Number DE93721624. Source: OSTI; NTIS.

This publication contains the proceedings of the international meeting of Finnwind'90, held in Pori, Finland, on 19-20 October 1990.

1701 Resources and Availability (Climatology)

Refer also to citation(s) 422, 815

407 (NEI-FI–168, pp. 88-95) **Wind energy development in Finland.** Peltola, E. (Technical Research Centre of Finland, Espoo (Finland). Lab. of Electrical and Automation Engineering). Finnish Wind Power Association, Espoo (Finland). 1990. (CONF-9010521–: FINNWIND'90: conference on wind power in Finland, Pori (Finland), 19-20 Oct 1990). In *Finnwind'90: Presentations.* 120p. Order Number DE93721624. Source: OSTI; NTIS.

The paper describes the present wind energy activities in Finland. The results of the national research programme on Advanced energy systems NEMO show e.g. that wind energy could contribute 10 % of the electric energy in Finland. In the near future one of the most important goals is to demonstrate the technical as well as the economical feasibility of wind power in Finland.

408 (NEI-FI–168, pp. 116-120) **The use of numerical maps for description of effective roughness.** Tammelin, B. (Finnish Meteorological Institute, Helsinki (Finland)); Wolff, J. Finnish Wind Power Association, Espoo (Finland). 1990. (CONF-9010521–: FINNWIND'90: conference on wind power in Finland, Pori (Finland), 19-20 Oct 1990). In *Finnwind'90: Presentations.* 120p. Order Number DE93721624. Source: OSTI; NTIS.

The roughness of the terrain around the site of a planned WECS has a great effect on the estimated wind energy resources. Typically the effective roughness has to be calculated for twelve wind directions for several distances. In Finland the typical sites of WECS are on the inhomogeneous coast or in the shattered archipelago. The use of numerical maps produced mainly for purposes of forest analysis provides a helpful tool to analyze the terrain at such a sites, especially when several sites are to be compared.

1704 Economic, Industrial, and Business Aspects

Refer also to citation(s) 365, 366, 367, 808, 809, 814

409 (ECN-C–92-048) **Development of windpumps at ECN: Period 01-07-1991 to 01-07-1992.** Van der Borg, N.J.C.M.; Van Hulle, F.J.L. Netherlands Energy Research Foundation (ECN), Petten (Netherlands). Jul 1992. 14p. Contract FOS ww/91/670. Order Number DE92557320. Source: OSTI; NTIS (US Sales Only); INIS.

In the period 1975 to 1990 the Directorate-General International Cooperation (DGIS) in the Netherlands has supported the Consultancy Services Wind Energy for Developing Countries (CWD) in developing wind pumps for the Third World. In 1990 the Netherlands Energy Research Foundation (ECN) was contracted by DGIS to prepare a manufacturing research project, starting from the CWD achievements. This preparation project was concluded in May 1991. DGIS contracted ECN to carry out a continuation project from 1 July 1991 to 1 July 1992 with the objective to keep the facilities that were realized within the framework of this project in operation and to continue the service concerning wind pumps until the manufacturing project is possibly contracted. The facility concerns the CWD2740 wind pump, the measuring system. The Business Unit Renewable Energies of ECN also serves as a contact address for information dissemination. 1 ill., 3 tabs., 4 refs.

410 (EUR–13837) **Proceedings wind energy R and D contractor meeting.** Caratti, G. (ed.). Commission of the European Communities, Luxembourg (Luxembourg). 1991. 215p. (CONF-9106402–: Meeting of the contractors of the research and development programme into wind energy 1990-1992, Maastricht (Netherlands), 12-14 Jun 1991). Source: OSTI; NTIS (US Sales Only); INIS.

This books contains a collection of progress reports from the participating contractors in the wind energy R and D sub-programme within the JOULE (Joint Opportunities for Unconventional or Long term Energy supply) programme on non-nuclear energy and rational use of energy. The current wind energy programme consists of 25 multi-partner projects which are closely interrelated and cover a broad spectrum of topics. These are grouped within the following research areas: A: Wind measuring and modelling; B: Wind turbine experiments and utilisation; C: Development of components and models; D: Stand-Alone and offshore; E: Large-wind turbines.

411 (NEI-FI–168, pp. 3-9) **Commercialisation of wind farms in Europe by the year 2000.** Musgrove, P. (Wind Energy Group, Hayes (GB)); Lindley, D. Finnish Wind Power Association, Espoo (Finland). 1990. (CONF-9010521–: FINNWIND'90: conference on wind power in Finland, Pori (Finland), 19-20 Oct 1990). In *Finnwind'90: Presentations.* 120p. Order Number DE93721624. Source: OSTI; NTIS.

By the end of 1989 approximately 325 MW of wind turbine capacity had been installed in Europe, corresponding to the grid connection of over 3000 wind turbines. Although this is only about one quarter of the capacity installed in California it is now becoming clear that Europe will see major market growth through the early 1990s. The progress that has been made towards the commercialisation of wind energy in the European Community up to 1990 is reviewed, and it is shown that wind energy has the potential to make a substantial contribution towards European electricity needs, and in so doing can: reduce European dependence on imported fuels, help meet European goals for reduced carbon dioxide emissions, and reduce acid rain emissions. Electricity from wind farms on good European sites is already cheaper than nuclear power, and is close to competitive with electricity from coal. In fact if compensation is given for the environmental damage avoided (through the absence of polluting emissions) then wind energy is already competitive with coal in large areas of Europe. Europe could and should target to achieve 10 % of its electricity needs from the wind by the second quarter of the next century. This will require the installation of 100 000 MW of wind turbines. Over the next, crucial, decade it is realistic to set a target of 5000 MW installed by the year 2000, with an installation rate by then of over 1000 MW/year. However political action is required if these goals are to be met, to ensure that wind generated electricity gets paid an equitable price that includes allowance for the avoided external costs.

412 (NEI-FI–168, pp. 18) **Wind energy technological development in Denmark.** Rasmussen, F. (Risoe Nat. Lab., Roskilde (Denmark). The Test Station for Wind Turbines). Finnish Wind Power Association, Espoo (Finland). 1990. (CONF-9010521–: FINNWIND'90: conference on wind power in Finland, Pori (Finland), 19-20 Oct 1990). In *Finnwind'90: Presentations.* 120p. Order Number DE93721624. Source: OSTI; NTIS.

Short communication. DENMARK/wind power; DENMARK/energy policy; DENMARK; WIND TURBINES; WIND POWER PLANTS; PLANNING

1705 Environmental Aspects

Refer also to citation(s) 410, 411, 801

413 (INIS-mf–13362, pp. 062-066) **A 3 MW wind power plant at Maglarp in Sweden.** Koc, B. Czechoslovak Solar Energy (Czechoslovakia); Ceske Vysoke Uceni Technicke, Prague (Czechoslovakia). 1991. 121p. (In Czech). (CONF-9107237–: Renewable energy sources '91 international conference, Prague (Czechoslovakia), 1 Jul 1991). In *Renewable energy sources '91. Part 2: Wind energy, biogas, small hydro.* Order Number DE93605634. Source: OSTI; NTIS (US Sales Only); INIS.

The wind power plant at Maglarp, in a frequented region of Sweden, is described. Its technical parameters are given and its environmental impacts are dealt with. The whiz of the rotor blades is heard at a distance of 500 to 1000 m; the author refers to the whiz as pleasant. Not a single bird has been found killed by the facility. Interference with the TV signal can at times be observed in the town; this is more marked with metal rotor blades than with blades made of reinforced plastic. A wing of the wind power plant concentrates on its surface an energy of about 20 kW per square meter. (M.D.).

1706 Wind Energy Engineering

Refer also to citation(s) 407, 409, 411, 808, 809, 815

414 (DOE/CH/10250–T1) **Field investigation of a wake structure downwind of a VAWT in a windfarm array.** Liu, H.T.; Buck, J.W.; Germain, A.C.; Hinchee, M.E.; Solt, T.S.; LeRoy, G.M.; Srnsky, R.A. Flow Research Co., Kent, WA (United States). Applied Mechanics Div. Oct 1987. 104p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC02-86CH10250. Order Number DE93001395. Source: OSTI; NTIS; GPO Dep.

The effects of upwind turbine wakes on the performance of a FloWind 17-m VAWT were investigated through a series of field experiments conducted at the FloWind windfarm on Cameron Ridge, Tehachapi, California. The field experiment was conducted within a VAWT array consisting of more than nine VAWTs with separations 3D crosswised by 8D downwind (where D is the turbine diameter) in a staggered configuration. The array is the upwind three rows of VAWTS in a total of six rows that are on top of the Cameron Ridge plateau. The terrain features in the vicinity are reasonably regular, with an upslope of 7 deg on the average; however, several local irregularities are present. The annual hourly averaged wind speed exceeds 8 m/s at the site. The wind field and the power-outputs of nine turbines within the array were measured with wind sensors and power transducers. Nine Gill propeller and 18 Maximum cup anemometers and one direction sensor were mounted on portable and stack-up towers installed upwind and within the turbine array. From the field measurements, the velocity and power/energy deficits were derived under various turbine on/off configurations. Much information was provided to characterize the structure of VAWT wakes and to assess their effects on the performance of downwind turbines. Recommendations are made for optimizing windfarm design and operations as well as for wind energy management.

415 (DOE/CH/10253–T1) **Free-flow variability on the Jess and Souza Ranches, Altamont Pass: [Final report].** Nierenberg, R. Altamont Energy Corp., Corte Madera, CA (United States). 25 Apr 1988. 171p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC02-86CH10253. Order Number DE93002939. Source: OSTI; NTIS; GPO Dep.

A central monitoring computer was installed on each ranch. The computers were connected by communication cables to 50 turbines on the Souza Ranch and 150 turbines on the Jess Ranch. Anemometers were installed on every other turbine on 12-foot booms at 35 feet above ground level (AGL). Spacing between anemometers was approximately 200 feet in the crosswind direction by 500 feet in the parallel direction. A total of 23 turbines on the Souza Ranch was instrumented in this fashion, as well as two multi-level meteorological towers. On the Jess Ranch, 77 turbines were instrumented; about half at 35 feet AGL and half at 50 feet AGL, plus four additional towers. Wind data were collected for approximately a 100 hour period on each ranch. All turbines were shut down during these periods so that no turbine wakes would be present. The data periods were selected by the meteorologist to insure that they occurred during typical spring-summer flow regimes. The terrain features upwind of the site appear to play as significant a role in the flow variability as terrain features within the site.

416 (ECN-I–92-028) **Survey on frequency responses of pressure tubes installed in a 12.5 meter rotor blade.** Spaeth, M.; Stefanatos, N. Netherlands Energy Research Foundation (ECN), Petten (Netherlands). Jun 1992. 37p. Project ECN 4240. Order Number DE92557289. Source: OSTI; NTIS (US Sales Only).

A series of preparatory activities are envisaged with respect to the instrumentation of a 12.5 meter wind turbine rotor blade with a high speed pressure scanning system. Local static pressures at the surface of the rotor blade will be measured into chordwise direction. Therefore pressure taps are manufactured to guide the pressures via pressure tubes to the scanner system. The aim of the preparatory task was the investigation of the response of the pressure tubes to fluctuating pressure signals and the selection of the optimum geometrical characteristics of the pressure tubes. Different configurations of tubing have been tested to define the frequency response dependency on the geometrical characteristics of the tube. During the test sequences the pressure tubes were connected to the scanner system to obtain realisitc measurement conditions. The results of the work demonstrate that if the diameter of the pressure tubes is chosen 1 mm and if their length is $\leq$1 meter, no serious deformation of the pressure signal is seen for the frequency range of interest (0-40 Hz). 17 figs., 1 tab., 2 apps., 8 refs.

417 (ECN-I–92-029) **Selection of an anemometer for the measurement of wind turbulence.** Cervenka, S. Netherlands Energy Research Foundation (ECN), Petten (Netherlands). Jun 1992. 22p. Project ECN 4478. Order Number DE92557290. Source: OSTI; NTIS (US Sales Only).

A brief description is given of the different methods for the measurement of wind velocities. One of these methods, the ultrasonic method, was selected to measure wind velocity for purposes of wind turbulence studies. Other methods examined are the mechanical methods, cup and propellor, the hot wire method and the SODAR (SOund Detection And Ranging) Doppler and laser doppler methods. 8 refs.

418 (ETDE-IT–92-81) **Evaluation of damage caused by lightning current flowing through bearings of wind power generators.** Celi, O.; Pigini, A.; Garbagnati, E. Centro Elettrotecnico Sperimentale Italiano (CESI), Milan (Italy); Ente Nazionale per l'Energia Elettrica, Milan (Italy). 1991. 4p. Order Number DE93729442. Source: OSTI; NTIS (US Sales Only).

In this research study, lightning currents of different amplitude were applied to wind power generator roller bearings in different test conditions and the damage caused by the lightning current flow were analyzed. The various influences of the load acting on the bearing, the presence of lubricants, and bearing rotation were investigated.

419 (NEI-DK–953) **Development of wind/diesel module system.** Rasmussen, P. Nordvestjysk Folkecenter for Vedvarende Energi, Hurup (Denmark). Jul 1991 34p. (In Danish). Contract ENS-UVE-88.1206. Order Number DE93721383. Source: OSTI; NTIS.

The aim was to develope a practical industrial solution for a hybrid system for a wind turbine and diesel generator. The system is a modular design involving standard industrial components interconnected with a minimum of control equipment. Operation is simple and prices are low, due to the competitive market prices of the components. The power range is between 7 kW - 200 kW. The system is built around a local grid based on fixed AC frequency of 50-60 Hertz supplied from a semiconductor inverter with a back-up battery bank. The inverter uses pulse width modulation with a switch frequency over 10kHz, which enables the net filters to give a perfect sine wave output in accordance with normal standards for power quality. The storage battery bank has a capacity of 10 min. full load supply in order to average fluctuations in wind power. During low load periods, the battery alone can feed the local grid. A lower specific capacity could be attractive in order to minimize the overflow whilst retaining a high power output and efficiency at lower wind speeds. For smaller systems the DC technique is convenient, such as a 24 volt battery with DC consumption with the possibility of supplying AC through an inverter. In the case of larger systems, the diesel set and wind turbine should be divided into smaller units in order to operate one or more units separately. This will minimize partial load losses in parallel operation with wind power. (AB)

420 (NEI-FI–168, pp. 11-17) **Wind energy activities in Sweden.** Engstroem, S. (The National Energy Administration, Stockholm (Sweden)); Svensson, G. Finnish Wind Power Association, Espoo (Finland). 1990. (CONF-9010521–: FINNWIND'90: conference on wind power in Finland, Pori (Finland), 19-20 Oct 1990). In *Finnwind'90: Presentations.* 120p. Order Number DE93721624. Source: OSTI; NTIS.

National Swedish activities on wind power started in 1975 with a basic research programme. In 1979 two large WECS, Naesudden, 2 MW and Maglarp, 3 MW, were ordered, with full financing from public research funds. An evaluation was carried out in 1985. In 1988 the results of a siting study were published, recommending sites for more than 20 TWh/yr of wind power, most of it offshore. Today research funds handled by the National Energy Administration still bears the main responsibility for the basic research on wind energy, which is carried out at a level of SEK 15 M/yr,

whereas the utilities have increased their responsibility for the hardware development. Thus the new 3 MW wind turbine at Naesudden, which will have its first rotation during 1991, is 75 % funded to by utility funds. Other projects co-financed with the utilities and the manufacturing industry are the development of a 400 Kw turbine, a 220 Kw offshore pilot plant and further technical studies of full-scale off-shore wind power.

421 (NEI-FI–168, pp. 38-54) **Wind energy developments in the Netherlands: State of the art 1990.** Beurskens, J. (Netherlands Energy Research Foundation, Petten (Netherlands)). Finnish Wind Power Association, Espoo (Finland). 1990. (CONF-9010521–: FINNWIND'90: conference on wind power in Finland, Pori (Finland), 19-20 Oct 1990). In *Finnwind'90: Presentations.* 120p. Order Number DE93721624. Source: OSTI; NTIS.

The aim of the paper is to provide a realistic impression of the Netherlands wind energy activities. It does not pretend to be complete but will rather concentrate on developments which have a major impact on R and D. market and policy developments. The wind energy activities which are being undertaken in the Netherlands can roughly be split up into R and D related subjects on the one hand and demonstration, industrial and commercial projects on the other.

422 (NEI-FI–168, pp. 96-98) **Wind energy production in an icing environment - can it be done.** Makkonen, L. (Technical Research Centre of Finland, Espoo (Finland). Building Materials Lab.). Finnish Wind Power Association, Espoo (Finland). 1990. (CONF-9010521–: FINNWIND'90: conference on wind power in Finland, Pori (Finland), 19-20 Oct 1990). In *Finnwind'90: Presentations.* 120p. Order Number DE93721624. Source: OSTI; NTIS.

Short communication. POLAR REGIONS/wind power; WIND TURBINES/ice; ICE; HAZARDS; PLANNING; PILOT PLANTS

423 (NEI-FI–168, pp. 99-105) **New wind energy technologies: A new Finno-Danish cooperation.** Ahm, P. (PA-Energy A/S, Malling (Denmark)). Finnish Wind Power Association, Espoo (Finland). 1990. (CONF-9010521–: FINNWIND'90: conference on wind power in Finland, Pori (Finland), 19-20 Oct 1990). In *Finnwind'90: Presentations.* 120p. Order Number DE93721624. Source: OSTI; NTIS.

While the standard grid connected wind power technology certainly has reached the point of a major break through in Europe, a number of wind technology applications are still in the R and D phase; this paper intends to give an overview of 3 applications currently being investigated in a Finno-Danish industrial cooperation, including Neste Advanced Power Systems of Finland, Nordtank Energy Croup of Denmark and various consultancy companies. The wind technology applications being investigated are arctic applications, stand-alone applications and wind/hydrogen applications. The 2 first mentioned projects are treated in more detail by other papers at this conference.

1707 Health and Safety

Refer also to citation(s) 418

20 FOSSIL-FUELED POWER PLANTS

2001 Power Plants and Power Generation

Refer also to citation(s) 18, 19, 51, 91, 798, 980

424 (CONF-9205123–13) **Evaluation of austenitic alloys for advanced steam cycles and hot-gas cleanup systems.** Swindeman, R.W. Oak Ridge National Lab., TN (United States). [1992]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 6. annual fossil energy materials conference; Oak Ridge, TN (United States); 12-14 May 1992. Order Number DE93000724. Source: OSTI; NTIS; GPO Dep.

The fossil fuels power industry in the United States is experiencing a broad range of choices in meeting energy needs of the country. In the near term, life-extension with improved flexibility and reliability in existing plants is an issue of primary concern. In the longer range, improved efficiency will be needed, and this will come about by the development of advanced steam cycle and combined cycle power plants. vary significantly from one power plants. The performance requirements for structural materials vary significantly from one application to the next. Requirements become more demanding with increased service temperature. (1) Studies were completed of the potential of type 316N stainless steel for main streamline piping. Data for service-exposed base metal indicated good strength and ductility after many hours of service at 540°C. A CRE 16-8-2 stainless steel filler metal was found to be a good match for creep strength. (2) Stress-rupture testing of Gr-91 steel was undertaken to better define the strength of the steel at 600°C. It was found that the current stress allowables in the ASME Codes were representative of materials included in the original data base. (3) Research efforts were completed on austenitic alloys superheaters in an advanced steam cycle PC power plant. Testing of weldments was continued because of their general interest to industry. Both CRE 16-8-2 stainless steel and alloy 556 filler metals were tested to times exceeding 10,000 h. (4) Evaluation of modified alloy 800 was extended to temperatures above 700°C to support the need for materials in heat recovery and hot-gas cleanup systems that will experience service in the range of 760 to 925°C. (5) Efforts were begun to produce data needed to define acceptance criteria for new materials in pressure-bearing applications at temperatures above 816°C.

425 (DOE/PC/91154–T2) **Development of a high-performance coal-fired power generating system with pyrolysis gas and char-fired high temperature furnace (HITAF): Quarterly progress report 2, April–June 1992.** Foster Wheeler Development Corp., Livingston, NJ (United States). Jul 1992. 46p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-91PC91154. Order Number DE92041249. Source: OSTI; NTIS; GPO Dep.

The system proposed to meet these goals is a combined-cycle system where air for a gas turbine is indirectly heated to approximately 1800°F in furnaces fired with coal-derived fuels and then directly heated in a natural-gas fired combustor up to about 2400°F. The system is based on a pyrolyzing process that converts the coal into a low-Btu fuel gas and char. The fuel gas is a relatively clean fuel, and it is fired to heat tube surfaces that are susceptible to corrosion and problems from ash deposition. In particular, the high-temperature air heater tubes, which will need to be a ceramic material, will be located in a separate furnace or region of a furnace that is exposed to combustion products from the low-Btu fuel gas only. Bechtel investigated different cycle analysis programs, and one was selected for use on this project. The program was then run for different pyrolyzer conditions, steam conditions, and gas turbine blade cooling airflow. This information yielded trends that were used to develop preliminary cycle parameters. Next, all team members estimated the range of significant operating parameters and capacities for their equipment. Bechtel then determined a plant size and equipment arrangement that would be reasonable for the commercial plant design. The cycle analysis, plant size, and equipment arrangement developed in this subtask will serve as a starting point for the subsystem and component R&D. After the subsystem R&D and the necessary trade-off studies have been completed, the cycle analysis and plant arrangement will be re-evaluated.

426 (ENEL-CRTN-T6–91-15) **Boiler pressure drop: Review of ENEL cycle chemistry experience.** Sigon, F.; Quadri, G. Ente Nazionale per l'Energia Elettrica, Milan (Italy). Centro Termica e Nucleare. 1991. 28p. Order Number DE93729438. Source: OSTI; NTIS (US Sales Only).

ENEL (Italian Electricity Board) research and long term plant experience on the effects of cycle chemistry on boiler pressure drop increasing with operating time are reviewed. The information refers specifically to fossil fired power plants with AVT (All Volatile Treatment) cycle chemistry and once-through and drum boilers. The most relevant chemistry parameters are considered in the search for correlations and in the investigation of possible mechanisms related to the phenomenon.

2002 Waste Management

Refer also to citation(s) 47, 71, 72, 73, 85, 1499, 1543, 1634

427 (ANL/ESD/TM–35) **Emissions of airborne toxics from coal-fired boilers: Mercury.** Huang, H.S.; Livengood, C.D.; Zaromb, S. Argonne National Lab., IL (United States). Energy Systems Div. Sep 1991. 35p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE93002760. Source: OSTI; NTIS; GPO Dep.

Concerns over emissions of hazardous air Pollutants (air toxics) have emerged as a major environmental issue, and the authority of the US Environmental Protection Agency to regulate such pollutants was greatly expanded through the Clean Air Act Amendments of 1990. Mercury has been singled out for particular attention because of concerns over possible effects of emissions on human health. This report evaluates available published information on the mercury content of coals mined in the United States, on mercury emitted in coal combustion, and on the efficacy of various environmental control technologies for controlling airborne emissions. Anthracite and bituminous coals have the highest mean-mercury concentrations, with subbituminous coals having the lowest. However, all coal types show very significant variations in mercury concentrations. Mercury emissions from coal combustion are not well-characterized, particularly with regard to determination of specific mercury compounds. Variations in emission rates of more than an order of magnitude have been reported for some boiler types. Data on the capture of mercury by environmental control technologies are available primarily for systems with electrostatic precipitators, where removals of approximately 20% to over 50% have been reported. Reported removals for wet flue-gas-desulfurization systems range between 35 and 95%, while spray-dryer/fabric-filter systems have given removals of 75 to 99% on municipal incinerators. In all cases, better data are needed before any definitive judgments can be made. This report briefly reviews several areas of research that may lead to improvements in mercury control for existing flue-gas-clean-up technologies and summarizes the status of techniques for measuring mercury emissions from combustion sources.

428 (DOE/FE–0265P) **Comprehensive report to congress Clean Coal Technology Program: Milliken Clean Coal Technology Demonstration Project.** USDOE Assistant Secretary for Fossil Energy, Washington, DC (United States). Office of Clean Coal Technology. Sep 1992. 50p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93001756. Source: OSTI; NTIS; GPO Dep.

In response to the PON, 33 proposals were received by DOE in May 1991. After evaluation, nine projects were selected for award. One of the nine projects selected for funding is a project proposed by the New York State Electric & Gas Corporation called the Milliken Clean Coal Technology Demonstration. This project will provide full-scale demonstration of a combination of innovative emission-reducing technologies and plant upgrades for the control of sulfur dioxide (SO_2) and nitrogen oxides (NO_x) emissions from a coal-fired steam generator, without a significant loss of efficiency. The Saarberg-Hoelter Umwelttechnick (S-H-U) process will be used to reduce SO_2 emissions by up to 98%. In the S-H-U process, the flue gas is scrubbed with a limestone slurry in an absorber vessel that does not contain packing or grid work. The lack of packing results in a low pressure drop across the absorber, which decreases energy requirements. The S-H-U slurry is maintained at a low pH by adding formic acid, which acts as a buffer, to the limestone slurry. A slipstream is processed for recovery of high-quality by-product gypsum and calcium chloride. Water is recovered and recycled to the process. This will be the first US demonstration of the S-H-U process and will include the innovative feature of a tile-lined, split-flow absorber constructed below the flues. NO_x emissions will be reduced by a combination of combustion modifications and the installation of the NO_xOUT urea injection technology. The NO_xOUT technology is capable of reducing NO_x emissions without affecting the salability of the flyash.

429 (DOE/PC/89652–T7) **Demonstration of Selective Catalytic Reduction (SCR) technology for the control of nitrogen oxide (NO_x) emissions from high-sulfur coal-fired boilers: Innovative Clean Coal Technology (ICCT): Quarterly report No. 7, January–March 1992.** Southern Co. Services, Inc., Birmingham, AL (United States). May 1992. 43p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC22-90PC89652. Order Number DE92041250. Source: OSTI; NTIS; GPO Dep.

The objective of this project is to demonstrate and evaluate commercially available Selective Catalytic Reduction (SCR) catalysts from US, Japanese and European catalyst suppliers on a high-sulfur US coal-fired boiler. SCR is a post-combustion nitrogen oxide (NO_x) control technology that involves injecting ammonia into the flue gas generated from coal combustion in an electric utility boiler. The flue gas containing ammonia is then passed through a reactor that contains a specialized catalyst. In the presence of the catalyst, the amonia reacts with NO_x to convert it to nitrogen and water vapor. Although SCR is widely practiced in Japan and Europe, there are numerous technical uncertainties associated with applying SCR to US coals. These uncertainties include: (1) potential catalyst deactivation due to poisoning by trace metal species present in US coals that are not present in other fuels. (2) performance of the technology and effects on the balance-of-plant equipment in the presence of high amounts of SO, and SO_3. (3) performance of a wide variety of SCR catalyst compositions, geometries and methods of manufacture under typical high-sulfur coal-fired utility operating conditions. These uncertainties will be explored by constructing a series of small-scale SCR reactors and simultaneously exposing different SCR catalysts to flue gas derived from the combustion of high sulfur US coal. The demonstration will be performed at Gulf Power Company's Plant Crist Unit No. 5 (75 MW capacity) near Pensacola, Florida. The project will be funded by the US Department of Energy (DOE), Southern Company Services, Inc. (SCS on behalf of the entire Southern electric system), and the Electric Power Research Institute.

430 (DOE/PC/90292–T5) **Alternative formulations of regenerable flue gas cleanup catalysts: Progress report, September 1, 1991–November 30, 1991.** Mitchell, M.B.; White, M.G. Clark Atlanta Univ., GA (United States). 27 Aug 1992. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-90PC90292. Order Number DE92041248. Source: OSTI; NTIS; GPO Dep.

Progress includes studies of the adsorption and desorption of SO_2 on alumina and impregnated alumina. This report describes the adsorption and desorption characteristics of sulfur dioxide in contact with a high purity γ-alumina and initial results of our efforts to prepare samples of the γ-alumina decorated with magnesium acetylacetonate dehydrate $[Mg(acac)_2{\cdot}2H_2O]$. The NOXSO regenerable flue gas cleanup catalyst uses a γ-alumina which has been doped with sodium through an aqueous impregnation with sodium carbonate and subsequent calcination. We are investigating other metals as promoters for the adsorption Of $S0_2$ and NO_x on alumina. We have characterized the aluminas with regard to impurities present and crystallinity and have set up a controlled environment infrared spectroscopic cell and thermal gravimetric apparatus. These issues have been covered in previous reports. In this report, we report our adsorption/desorption studies of $S0_2$ on pure alumina. As part of our investigation of the modification of alumina surfaces for the selective adsorption Of $S0_2$, we are investigating the use of non-aqueous impregnation techniques for the preparation of well-dispersed monolayers of promoters on alumina surfaces.

431 (DOE/PC/90361–T7) **Catalytic fabric filtration for simultaneous NO_x and particulate control: Quarterly technical progress report, April 1–June 30, 1992.** Weber, G.F.; Ness, S.R.; Laudal, D.L.; Dunham, G. North Dakota Univ., Grand Forks, ND (United States). Energy and Environmental Research Center. Aug 1992. 72p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-90PC90361. Order Number DE93000645. Source: OSTI; NTIS; GPO Dep.

The objective of this program is to develop advanced concepts for the removal of NO_x from flue gas emitted by coal-fired utility boilers, or for the control of NO_x formation by advanced combustion modification techniques. Funded projects are required to focus on the development of technology that significantly advances the

state of the art using a process or a combination of processes capable of reducing NO_x emissions to 60 ppm or less. The concept must have successfully undergone sufficient laboratory-scale development to justify scaleup for further evaluation at the pilot scale (not to exceed 5 MWe in size). The EERC approach to meeting the program objective involves the development of a catalytic fabric filter for simultaneous NO_x and particulate control. The idea of applying either permanent or throwaway catalysts to a high-temperature fabric filter for NO_x control is not new. However, advances at OCF have shown that a high-activity catalyst can be applied to a high-temperature woven glass cloth resulting in a fabric filter material that can operate at temperatures higher than the maximum operating temperatures of commercially available, coated glass fabric. The NO_x is removed by catalytic reduction with ammonia to form nitrogen and water. The catalyst employed at this time is vanadium/titanium, but the exact catalyst composition and the unique method of applying the catalyst to high-temperature glass fabric are the property of OCF. Other catalyst options are being evaluated by OCF in order to improve catalyst performance and minimize catalyst cost.

432 (DOE/PC/90365–T7) **Fundamental mechanisms in flue gas conditioning: Quarterly report, April 1992–June 1992.** Snyder, T.R.; Vann Bush, P. Southern Research Inst., Birmingham, AL (United States). 27 Jul 1992. 31p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-91PC90365. (SRI-ENV–92-603-7375-Q4). Order Number DE92040539. Source: OSTI; NTIS; GPO Dep.

SEM pictures of the three mixtures of sorbent and ash from the DITF and the base line ESP hopper ash from Muskingum are shown in Figures 1 through 4. The effects of sorbent addition on particle morphology are evident in Figures 2 through 4 by the presence of irregularly shaped particles and deposits on the surfaces of the spherical fly ash particles. In contrast, the base Ene ash particles have the characteristic relatively smooth, spherical morphology normally associated with pulverized-coal (PC) fly ashes. Resistivity determinations made on these four ashes in ascending and descending temperature modes. These data are shown in Figures 5 and 6. Sorbent injection processes performed at the DITF lowered the duct temperature to around 165°F from about 350°F for base line operation. Consequently, during collection in the ESP, the particulate matter from the sorbent injection processes had a significantly lower resitivity (approximately 4×10^7 Ω-cm) than the base line ash (approximately 3×10^{11} Ω-cm at 350°F). Specific surface areas and true particle densities have been measured for the four samples obtained from the DOE/PETC Duct Injection Test Facility. These data are summarized in Table 4. The primary difference indicated by these initial analyses of these four samples is the significant increase in specific surface area due to sorbent addition. The specific surface areas of the three sorbent and ash mixtures from the DITF are quite similar.

433 (DOE/PC/90505–T9) **Mechanism of surface enrichment and adhesion of coal combustion particulates: Final report.** Shadman, F.; Peterson, T.W.; Wendt, J.O.L. Arizona Univ., Tucson, AZ (United States). Dept. of Chemical Engineering. [1992]. 306p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-86PC90505. Order Number DE92040421. Source: OSTI; NTIS; GPO Dep.

This study focuses on the effect of alkali adsorption on the agglomeration of particles of bauxite, kaolinite, emathlite, lime, and two types of coal ash. An agglomeration (adhesion) temperature is defined which characterizes the adhesion propensity of particles. Using a small fluidized bed, a unique experimental technique is developed to measure this agglomeration point in-situ. The effects of alkali adsorption on the agglomeration characteristics of the substrates are determined. The agglomeration temperature of all substrates decreases as the alkali content increases. At low alkali loadings, alkali adsorption enhances particle agglomeration by forming new compounds of lower melting points. At high alkali concentrations, adhesion and agglomeration are caused by a layer of molten alkali which covers the exterior of the particles. Alkali surface composition of particles is studied using a Scanning Auger Microprobe (SAM). Results indicate that the alkali surface concentration decreases as agglomeration temperature increases. The use of additives to scavenge alkali vapors is further studied in a pilot scale downflow combustor. SAM surface analyses of additive particles indicate three mechanisms of alkali capture. Adsorption by reaction, surface condensation, and nucleation and coagulation with additive particles. These mechanisms may occur independently or simultaneously depending primarily on the alkali vapor concentration and the temperature profile along the combustion furnace. A mathematical model is developed to represent the kinetics and mechanisms of the alkali adsorption and agglomeration process. Modeling results indicate that the adsorption-reaction process is influenced by diffusion of alkali through the surface product layer. The model predictions of the alkali adsorbed as a function of minimum agglomeration temperature agree very well with the experimental results.

434 (DOE/PC/91284–T1) **Nitration of polynuclear aromatic hydrocarbons in coal combustors and exhaust streams: Quarterly report, September 1, 1991–December 31, 1991.** Yu, Liya; Dadamio, J.; Hildemann, L.; Niksa, S. Stanford Univ., CA (United States). Aug 1992. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-91PC91284. Order Number DE93000916. Source: OSTI; NTIS; GPO Dep.

Nitro-polynuclear aromatic hydrocarbons (nitro-PAH) are the predominant mutagens on respirable particles from coal-fired boilers. Since nitro-PAH are not primary products of coal devolatilization, their formation must involve secondary chemistry at elevated temperatures. However, it is not known where in the combustion or exhaust processes they form, which reaction species are involved, or how concentrations are influenced by operating conditior.s. Results from this study will help to relate the environmental impact of mutagenic emissions to boiler firing strategies. The objectives of this three-year project are to (1) identify the conditions which promote the nitration of PAH during primary combustion, reburning, hot gas cleanup, and particulate removal; and (2) investigate the potential relationship between NO_x abatement and PAH nitration. A novel coal flow reactor burning actual coal products operates over the domains of heating rates, temperatures, fuel-equivalence ratios, and residence times in utility boilers. A fluidized bed will be built for studies of simulated hot gas cleanup at lower temperatures. Gas chromatography with chemiluminescence detection will measure the aggregate amount of nitro groups present, to determine when nitro-PAH first appear, and how nitration is affected by the operating conditions. Tars from primary and secondary pyrolysis and oxidative pyrolysis will be fractionated into chain hydrocarbons, polynuclear aromatics, oxygenated species, and a basic fraction, so that their ring number distribution can be monitored with high performance liquid chromatography.

435 (DOE/PC/91306–3) **Sorption and chemical transformation of PAHs on coal fly ash: Technical progress report No. 3, May 1–July 31, 1992.** Mamantov, G.; Wehry, E.L. Tennessee Univ., Knoxville, TN (United States). Dept. of Chemistry. [1992]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-91PC91306. Order Number DE93000518. Source: OSTI; NTIS; GPO Dep.

The results obtained to date indicate that toluene is a useful "probe solute" for measuring the relative affinities of various fly ash fractions for aromatic solutes. In general, the adsorption isotherms obtained for toluene on fly ash fractions can be fit to a Freundlich adsorption isotherm equation, which implies that the adsorbent surface in question is heterogeneous. For most fly ash fractions studied thus far, the measured heat of adsorption decreases as the quantity of toluene injected onto the column increases. This observation also indicates that the fly ash surfaces are heterogeneous. For a homogeneous (or nearly homogeneous) surface, virtually all adsorption "sites" for a particular solute exhibit approximately the same affinity for the solute; hence, the measured heat of adsorption is virtually independent of the amount of solute that is brought into contact with the surface. However, when the surface is heterogeneous, the measured heat of adsorption decreases as the amount of solute is increased; this variation can be used to make inferences regarding surface site energy distributions if certain assumptions and approximations are made. Data obtained to date are summarized.

436 (DOE/PC/91344–T1) **Advanced separation technology for flue gas cleanup: Quarterly technical report No. 1.** SRI International, Menlo Park, CA (United States). Jul 1992. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-92PC91344. Order Number DE92040519. Source: OSTI; NTIS; GPO Dep.

The objective of this work is to develop a novel system for regenerable SO_2 and NO_x scrubbing of flue gas that focuses on (a) a novel method for regeneration of spent SO_2 scrubbing liquor and (b) novel chemistry for reversible absorption of NO_x. In addition, high efficiency hollow fiber contactors (HFC) are proposed as the devices for scrubbing the SO_2 and NO_x from the flue gas. The major cost item in existing technology is capital investment. Therefore, our approach is to reduce the capital cost by using high efficiency hollow fiber devices for absorbing and desorbing the SO_2 and NO_x. Our novel chemistry for scrubbing NO_x win consist of water soluble phthalocyanine compounds invented by SRI and also of polymeric forms of Fe^{++} complexes similar to traditional NO_x scrubbing media described in the open literature. Our past work with the phthalocyanine compounds, used as sensors for NO and NO_2 in flue gases, shows that these compounds bind NO and NO_2 reversibly and with no interference from O_2, CO_2, SO_2, or other components of flue gas. The final novelty of our approach is the arrangement of the absorbers in cassette (stackable) form so that the NO_x absorber can be on top of the SO_x absorber. This arrangement is possible only because of the high efficiency of the hollow fiber scrubbing devices, as indicated by our preliminary laboratory data.

437 (VTT-TIED–1341) **Function and field property of on-line measurement meters.** Vesterinen, R. (Technical Research Centre of Finland, Jyvaeskylae (Finland). Combustion and Thermal Engineering Lab.). Technical Research Centre of Finland, Espoo (Finland). 1992. 100p. (In Finnish). Order Number DE93711153. Source: OSTI; NTIS.

Comparisons of sulphur dioxide and nitrogen oxide meters at the Rauhalahti power plant, and of two sulphur dioxide meters at bark-fueled power plants were made in this research. Six sulphur dioxide meters and three nitrogen oxide meters were included in the comparison. Dust density/particle content of flue gases was also measured by one of the meters, carbon monoxide content with one of the meters, and carbon dioxide and water content with one meter. Daily average indicated by five sulphur dioxide meters was within the range of 10 %. The hourly dispersion of the meters was, however, higher. The results given by one of the meters was one half or one third of those of the others. The results of the nitrogen oxide meters were within the same limits as the main part of the sulphur dioxide meters. The Sick GM 21 and Opsis meters, measuring through the channel, had been calibrated by the manufacturer and could not be readjusted by using calibration gas. The Ultramat 5, Binos and ML 8850 sulphur dioxide meters kept their calibration level well. The ML 8840 nitrogen oxide meter kept its zero level well, but the measuring area varied slightly during the one week calibration period. The Sick GM 21 kept the collimation of the beam well during the measuring period. The best experiences in Finnish plants are of those obtained by continuous action oxygen and dust density metering devices. The oxygen meters have been considered accurate, but in the case of dust density meters the opinions have been scattered. There is less experience of sulphur dioxide and nitrogen oxide meters. The measurement of sulphur dioxide with both devices based on continuous sampling and in situ meters was most problematic in soda recovery boiler plants.

2005 Environmental Aspects

Refer also to citation(s) 795, 1481, 1493, 1634, 1635

438 (DTH-LA–41) **Active reduction of the dominant clear tone component of the noise pollution from power plant chimneys.** Burmand Johannesson, R. Danmarks Tekniske Hoejskole, Lyngby (Denmark). Lab. for Akustik. Oct 1991. 42p. (In Danish). Order Number DE93721473. Source: OSTI; NTIS; INIS.

An investigation of a system for active reduction of an irritating dominant clear tone emitted as a part of the noise pollution from a power plant chimney is described. Experiments were carried out on a scale model with diameters 3-4 times less than the actual chimney. Reduction of 25-30 decibels was achieved in relation to the clear tone in the frequency range in connection with which it could be expected that the noise-muffling system would work. The system was also seen to be able to follow the expected variation in the noise signals and to be stable during a longer period of time. The theories on which the experiment was based, the experimental setup and measurement methods and results are presented. (AB).

2006 Economic, Industrial, and Business Aspects

439 (GB–452) **Annual report and accounts 1991/92.** Scottish Nuclear Ltd., Glasgow (United Kingdom). 1992 50p. Order Number DE93722379. Source: OSTI; NTIS (US Sales Only); INIS.

This annual report of Scottish Power highlights profit before tax; earnings per share; dividends; net debt reduction; the significant progress achieved in Company restructuring; and the fact that domestic customers now have the lowest tarrifs in the United Kingdom. A summary of the Company's results is given, and competitive opportunities, exports, transmission and distribution, and environmental issues are discussed. (author).

21 NUCLEAR POWER REACTORS AND ASSOCIATED PLANTS

Refer also to citation(s) 1237, 2406, 2407

440 (EUR–14363, pp. 3-9) **Decommissioning operational experience in AEA technology.** Jones, J.M. Commission of the European Communities, Luxembourg (Luxembourg). 1992. (CONF-9109441–: 2. Seminar on practical decommissioning experience with nuclear installations in the European Community, Sellafield (United Kingdom), 25-26 Sep 1991). In *Practical decommissioning experience with nuclear installations in the European Community.* 207p. Order Number DE93721081. Source: OSTI; NTIS (US Sales Only); INIS.

The UK Nuclear industry is over 40 years old with AEA Technology which has been and is involved in the decommissioning of a wide range of redundant nuclear facilities: reactors, alpha facilities and other plants. A number of different constraints affect both the level and type of decommissioning operations undertaken on redundant facilities. There is the regulatory framework within which we have to operate, the availability of decommissioning operations undertaken on redundant facilities, funding and, certainly within the UK, the availability of viable waste disposal routes.

441 (INIS-mf–13366) **Implementation of quality assurance corrective actions.** Bezpecnost Jadernych Zarizeni. Ceskoslovenska Komise pro Atomovou Energii, Prague (Czechoslovakia). 1992 95p. Translation of IAEA publication (Technical Report Series. No. 317). International Atomic Energy Agency, Vienna 1990. (In Czech). Order Number DE93605772. Source: OSTI; NTIS (US Sales Only); INIS.

In quality assurance practice, the corrective action process is often thought of as simply a mechanism for remedying a specific non-conformance. The initiation of corrective action to preclude recurrence of the non-conformance is therefore frequently overlooked. This issue has been identified as a major problem in the implementation of an effective quality assurance programme. In this connection, it may be noted that quality assurance practitioners devote about half of their time to non-conformance and corrective action activities and there is a need for more detailed guidance on this subject. The IAEA has therefore developed this Manual to serve as guidance to Member States on non-conformance and corrective actions. It offers a practical model and illustrative examples of the means by which effective measures and actions can be implemented. The scope of the Manual, while fully addressing the requirements in the governing Nuclear Safety Standards (NUSS) programme documents, also covers corrective action processes which would more generally assist users in developing good practice for improved performance in all areas of safety, reliability and economics. 2 figs.

442 (KAERI/RR–1047/91) **The development of robot application technology in nuclear facilities.** Kim, Seung Ho (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Lee, Jong Min; Kim, Chang Hoe; Kim, Byung Soo; Sohn, Surg Won; Hwoang, Suk Yeoung; Lee, Yong Bum; Kim, Woong Ki. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Jan 1992. 160p. (In Korean). Order Number DE93605773. Source: OSTI; NTIS (US Sales Only); INIS.

The goal of this project is to develop a mobile teleoperated system to do the job effectively of inspection and light duty maintenance work inside the containment buildings under severe environments. This is the second year of the project. Basically remotely controlled concept was adopted to a mobile robot which was equipped with 7 degrees of freedom anthropomorphic manipulator providing dexterous control. Closed-loop schemes for solving the inverse kinematics of the redundant manipulator were investigated and decentralized adaptive controller was designed for the end effector to track the desired trajectory. A new stair climbing algorithm was proposed to go over irregular stairs, and simulations and experiments were carried out. User-friendly teleoperated control console was designed to comply with human engineering. Off-line programming technique has been developing to enhance the safety and efficiency in task assignment of robot. This research will in consequence be in a strong position to bid for further work in this area. (Author).

2101 Power Reactors, Nonbreeding, Light-Water Moderated, Boiling Water Cooled

Refer also to citation(s) 540, 612, 717, 718, 721

443 (EUR–13906) **Summary of the dimensioning verification studies of the Phebus-FP experiments.** Shepherd, I.M. (Commission of the European Communities, Ispra (Italy). Joint Research Centre); Markovina, A.G. Commission of the European Communities, Luxembourg (Luxembourg). 1992. 52p. Source: OSTI; NTIS (US Sales Only); INIS.

As preparation for the Phebus-FP project a set of scoping calculations were performed in order to check how well Phebus-FP is able to represent a severe accident sequence in a light water reactor. This report summarizes those calculations that deal with the coolant circuit between the bundle and containment vessel. Many calculations were performed by many different organizations and it was found that, although there was considerable quantitative disagreement, it was possible to simulate a severe accident sequence in Phebus-FP. Recommendations are made concerning the conduct of the test and deficiencies in the codes used to calculate the phenomena are pointed out.

444 (EUR–14037) **Hydrogen in water-cooled nuclear power reactors.** Commission of the European Communities, Luxembourg (Luxembourg). 1992. 302p. Source: OSTI; NTIS (US Sales Only); INIS.

The Commission of the European Community (CEC) and the International Atomic Energy Agency (IAEA) decided in 1989 to update the state of the art concerning hydrogen in water cooled nuclear power reactors by commissioning a report which would review, all the available information to-date and make recommendations for the future. This joint report was prepared by committees formed by the IAEA and by the CEC. The aim of this report is to review the current understanding on the areas in which the research on hydrogen in LWR is conventionally presented, taking into account the results of the latest reported research developments. The main reactions through which hydrogen is produced are assessed together with their timings. An estimation of the amount of hydrogen produced by each reaction is given, in order to reckon their relative contribution to the hazard. An overview is then given of the state of knowledge of the most important phenomena taking place during its transport from the place of production and the phenomena which control the hydrogen combustion and the consequences of combustion under various conditions. Specific research work is recommended in each sector of the presented phenomena. The last topics reviewed in this report are the hydrogen detection and the prevent/mitigation of pressure and temperature loads on containment structures and structures and safety related equipment caused by hydrogen combustion.

445 (EUR–14039) **Hydrogen behaviour and mitigation in water-cooled nuclear power reactors.** Della Loggia, E. (Commission of the European Communities, Brussels (Belgium). Directorate General for Science, Research and Development). Commission of the European Communities, Luxembourg (Luxembourg). 1992. 370p. (CONF-9103264–: Proceedings of a Workshop on Hydrogen behaviour and mitigation in water-cooled nuclear power reactors, Brussels (Belgium), 4-8 Mar 1991). Source: OSTI; NTIS (US Sales Only); INIS.

The Commission of the European Communities (CEC) and the International Atomic Energy Agency (IAEA), within the framework of their safety research activities, initiated and arranged a series of specialist meetings and research contracts on hydrogen behaviour and control. The result of this work is summarized in a report jointly prepared by the two international organizations entitled 'Hydrogen in water-cooled nuclear power reactors'. Independently, the Kurchatov Atomic Energy Institute organized a workshop on the hydrogen issue in Sukhumi, USSR, with CEC and IAEA cooperation. Commonly expressed views have emerged and recommendations were formulated to organize the subsequent seminar/workshop concentrating mainly on the most recent research and analytical projects and findings related to the hydrogen behaviour, and-most importantly-on the practical approaches and engineering solutions to the hydrogen control and mitigation. The seminar/workshop, therefore, addressed the 'theory and practice' aspects of the hydrogen issue. The workshop was structured in the following sessions: combustible gas production; hydrogen distribution; combustion phenomena; combustion effects and threats; and detection and migration.

446 (EUR–14039, pp. 28-37) **Hydrogen generation during reflooding of degraded core as an accident management measure.** Hidaka, A. (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment); Sugimoto, J.; Soda, K. Commission of the European Communities, Luxembourg (Luxembourg). 1992. (CONF-9103264–: Proceedings of a Workshop on Hydrogen behaviour and mitigation in water-cooled nuclear power reactors, Brussels (Belgium), 4-8 Mar 1991). In *Hydrogen behaviour and mitigation in water-cooled nuclear power reactors.* 370p. Order Number DE93721166. Source: OSTI; NTIS (US Sales Only); INIS.

Sensitivity analyses were performed to investigate a possible hydrogen generation during reflooding of degraded core which is considered as one of severe accident management strategies. The detailed accident analysis code, RELAP/SCDAP, was used for the present analysis in which the degraded core similar to the TMI-2 accident was postulated. More over the initiation timing and the rate of core reflooding were selected as parameters of the analysis. Two cases for the steam flow, which represented realistic assumption, and steam starved flow, which corresponded to a possible case where a large part of fuel cladding remained unoxidized. From the present analyses, it was concluded that; (i) reflooding of degraded core would become additional source of hydrogen generation, (ii) an amount of hydrogen generation during reflooding depends on the amount of remaining unoxidized zirconium in the core and the timing of reflooding initiation, (iii) in general, the early injection as possible would mitigate core degradation and consequently result in less hydrogen generation.

447 (EUR–14039, pp. 50-64) **Comparisons of fathoms blind and open post-test predictions with the experimental data of HDR-H_2-mixing tests E.11.2 and E.11.4.** Wolf, L. (Battelle-Institut e.V., Frankfurt am Main (Germany)); Holzbauer, H. Commission of the European Communities, Luxembourg (Luxembourg). 1992. (CONF-9103264–: Proceedings of a Workshop on Hydrogen behaviour and mitigation in water-cooled nuclear power reactors, Brussels (Belgium), 4-8 Mar 1991). In *Hydrogen behaviour and mitigation in water-cooled nuclear power reactors.* 370p. Order Number DE93721166. Source: OSTI; NTIS (US Sales Only); INIS.

Battelle-Institut e.V., Frankfurt, FRG, participated with the containment analysis code FATHOMS, Version 2.3, in the blind post-test computational PHDR-Benchmark Exercise on the HDR

long-term hydrogen mixing experiments E11.2 and E11.4. Quantitative results are shown in comparison with various data of both experiments. The levels of agreement for the different physical quantities are presented in detail and potential causes for deviations are discussed. Upon completion of the exercises, it became known that the insulation of the instrumentation cooling lines had deteriorated thus providing a substantial heat sink. This fact led to rather high overpredictions by all participants. Its effect has been accounted for by an open post-test FATHOMS computation the results of which are compared to those of the blind computations and the data.

448 (EUR–14039, pp. 74-80) **Three dimensional numerical simulation of hydrogen distribution and mixing in containment.** Barthel, V. (CEA Centre d'Etudes de Grenoble, 38 (France)); Grand, D.; Villand, M. Commission of the European Communities, Luxembourg (Luxembourg). 1992. (CONF-9103264–: Proceedings of a Workshop on Hydrogen behaviour and mitigation in water-cooled nuclear power reactors, Brussels (Belgium), 4-8 Mar 1991). In *Hydrogen behaviour and mitigation in water-cooled nuclear power reactors.* 370p. Order Number DE93721166. Source: OSTI; NTIS (US Sales Only); INIS.

This paper describes the adaptation of the three dimensional thermal-hydraulic code TRIO-VF to the study of hydrogen distribution throughout the containment during severe accident sequences. The original version of the code has been adapted to compressible fluid flows that can be mixtures of one to four constituents, one being water steam, the others gas components (air, H2,...). The mass conservation equations of the different constituents, the motion and energy conservation equations are strongly coupled. The turbulent (k-ϵ) model is used where transport equations of k and ϵ are considered. A wall condensation model has been introduced in order to take into account the influence of the film resistance along the wall. The different equations and models governing the fluid flow are presented. Some validation cases that have already been realized are described. A general validation case on one HDR experiment will soon be defined and calculated with the new adapted TRIO-VF code.

449 (EUR–14039, pp. 81-95) **Results of the PHDR computational Benchmark exercises on hydrogen distribution experiments E11.2 and E11.4.** Wolf, L. (Battelle-Institut e.V., Frankfurt am Main (Germany)); Valencia, L. Commission of the European Communities, Luxembourg (Luxembourg). 1992. (CONF-9103264–: Proceedings of a Workshop on Hydrogen behaviour and mitigation in water-cooled nuclear power reactors, Brussels (Belgium), 4-8 Mar 1991). In *Hydrogen behaviour and mitigation in water-cooled nuclear power reactors.* 370p. Order Number DE93721166. Source: OSTI; NTIS (US Sales Only); INIS.

International computational results of blind post-test computations for the HDR-hydrogen mixing experiments E11.2 and E11.4 are qualitatively compared with measured data. All well-known containment analyses codes participated in the PHDR-Benchmark Exercises which covered a number of various break and injection positions and also encompassed different elements of accident management measures such as outside and inside sprays. Potential causes for the observed differences between data and predictions are presented, both with respect to the provided input data as well as the modeling features chosen. The paper supplements the detailed informations about the experiments by adding the containment code verification aspects.

450 (EUR–14039, pp. 141-150) **Experimental results and modelling strategies for multi-compartment hydrogen deflagration.** Kanzleiter, T.F. (Battelle-Institut e.V., Frankfurt am Main (Germany)); Fischer, K.; Wennerberg, D. Commission of the European Communities, Luxembourg (Luxembourg). 1992. (CONF-9103264–: Proceedings of a Workshop on Hydrogen behaviour and mitigation in water-cooled nuclear power reactors, Brussels (Belgium), 4-8 Mar 1991). In *Hydrogen behaviour and mitigation in water-cooled nuclear power reactors.* 370p. Order Number DE93721166. Source: OSTI; NTIS (US Sales Only); INIS.

Recent large-scale experiments on hydrogen deflagration in multi-compartment geometries have shown considerable flame accelerations and pressure build-ups much higher than expected from the results of single-compartment experiments in the same concentration range. In a number of parametric studies, the various factors determining the flame propagation behavior were investigated. Modelling these processes in a lumped-parameter approximation is severely limited because of a lack of detailed geometric representation, while a distributed-parameter approximation is difficult to establish for realistic LWR containment geometries. The present paper shows that a combined modelling approach is able to resolve this problem, leading to a predictive mechanistic model for hydrogen deflagration events with practical relevance.

451 (EUR–14039, pp. 151-160) **Two models of hydrogen combustion in a closed cylinder.** Tiselj, I. (Institut Jozef Stefan, Ljubljana (Slovenia)); Kodre, A.; Mavko, B. Commission of the European Communities, Luxembourg (Luxembourg). 1992. (CONF-9103264–: Proceedings of a Workshop on Hydrogen behaviour and mitigation in water-cooled nuclear power reactors, Brussels (Belgium), 4-8 Mar 1991). In *Hydrogen behaviour and mitigation in water-cooled nuclear power reactors.* 370p. Order Number DE93721166. Source: OSTI; NTIS (US Sales Only); INIS.

Combustion of non-detonating air-hydrogen mixture in a cylindrical vessel is modelled by the full Navier-Stokes system of differential equations. Effects of turbulence are taken into account by phenomenological turbulent transport coefficients, chemical kinetics of the reaction is described by a single activation term. Good agreement with previously published data can be obtained by adjustment of boundary conditions at the vessel walls. A more efficient model, based on the incompressible-fluid approximation is developed and tested.

452 (EUR–14039, pp. 161-172) **Criteria for transition to detonation for hydrogen flames.** Chan, C.K. (Atomic Energy of Canada Ltd., Pinawa, MB (Canada). Whiteshell Nuclear Research Establishment). Commission of the European Communities, Luxembourg (Luxembourg). 1992. (CONF-9103264–: Proceedings of a Workshop on Hydrogen behaviour and mitigation in water-cooled nuclear power reactors, Brussels (Belgium), 4-8 Mar 1991). In *Hydrogen behaviour and mitigation in water-cooled nuclear power reactors.* 370p. Order Number DE93721166. Source: OSTI; NTIS (US Sales Only); INIS.

During postulated loss-of-coolant accidents in a nuclear power reactor, the H_2 generated from a metal/steam reaction may leak into the containment building and form a combustible atmosphere. If the gas mixture is ignited, the potential damage to the containment building and equipment within the containment depends on whether the combustion is a deflagration or a detonation. Direct initiation of detonation requires a high-energy initiation source such as a solid explosive. Such a source is not likely to be present in a containment environment. However, a detonation can occur via a deflagration-to-detonation transition (DDT). At the present time, the necessary conditions (or the criteria) for a DDT to occur have not been determined. It is not possible to predict a priori whether a transition can occur in a given situation. Recently, a few qualitative methods were proposed to assess the likelihood of a DDT. This paper reviews the current understanding of the transition phenomenon, and discusses the qualitative methods available for assessing the likelihood of a DDT. It briefly describes a recent study on turbulent/flame interaction to establish one of the necessary conditions for a DDT to occur. A new methodology for assessing DDT is also proposed to remove some of the conservatism that prevails in the other approaches.

453 (EUR–14039, pp. 173-183) **Mechano-chemical model of breakaway zirconium oxidation.** Fridman, A.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (Russian Federation). Inst. Atomnoj Ehnergii); Kirillov, I.A.; Rusanov, V.D. Commission of the European Communities, Luxembourg (Luxembourg). 1992. (CONF-9103264–: Proceedings of a Workshop on Hydrogen behaviour and mitigation in water-cooled nuclear power reactors, Brussels (Belgium), 4-8 Mar 1991). In *Hydrogen behaviour and mitigation in water-cooled nuclear power reactors.* 370p. Order Number DE93721166. Source: OSTI; NTIS (US Sales Only); INIS.

In order to make clear the long-term oxidation kinetics of steam-zirconium topochemical reaction and fuel cladding behavior under severe accident conditions the breakaway oxidation phenomenon have been considered. Autowave model of breakaway oxidation

have been developed. It has been proposed in this model that diffusion propagation of oxidation front is autocatalyzed by the oxide layer degradation. Within the frame work of the macroscopic model of quasi-brittle oxide layer fracture the analytical dependence of the breakaway oxidation rate coefficient, barrier layer thickness and characteristic crack length upon temperature and mechanochemical oxide parameters have been obtained. Comparison of theoretical calculations with existing experimental data have shown a good agreement. Proposed theoretical framework and models can be used in computer simulations and analytical assessment of the hydrogen generation, core heat-up and cladding embrittlement in severe fuel damage accidents conditions.

454 (EUR–14039, pp. 196-201) **Proving test on the reliability for reactor containment vessel (2) hydrogen burning test.** Takumi, K. (Nuclear Power Engineering Workshop, Tokyo (Japan)); Nonaka, A.; Ogata, J.; Moriya, K. Commission of the European Communities, Luxembourg (Luxembourg). 1992. (CONF-9103264–: Proceedings of a Workshop on Hydrogen behaviour and mitigation in water-cooled nuclear power reactors, Brussels (Belgium), 4-8 Mar 1991). In *Hydrogen behaviour and mitigation in water-cooled nuclear power reactors.* 370p. Order Number DE93721166. Source: OSTI; NTIS (US Sales Only); INIS.

Hydrogen burning test has been performed at Katsuta Engineering Laboratory of NUPEC. Some of the test results show good accordance with the previous data at SNL/FITS.

455 (EUR–14039, pp. 208-214) **Electrochemical devices for hydrogen concentration and pH measurements in the coolant of water-cooled reactors.** Vakar, M. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (Russian Federation). Inst. Atomnoj Ehnergii); Pakhomov, V. Commission of the European Communities, Luxembourg (Luxembourg). 1992. (CONF-9103264–: Proceedings of a Workshop on Hydrogen behaviour and mitigation in water-cooled nuclear power reactors, Brussels (Belgium), 4-8 Mar 1991). In *Hydrogen behaviour and mitigation in water-cooled nuclear power reactors.* 370p. Order Number DE93721166. Source: OSTI; NTIS (US Sales Only); INIS.

In spite of the fact that much attention, has been always paid on hydrogen safety of water-cooled reactors, accidents caused by explosions of hydrogen-oxygen mixtures accompany atomic energy through its history. Water radiolysis being an inherent property of a water-cooled reactor continuously sustains a possibility for dangerous situations at a nuclear power plant (NPP). The explosion even of a small amount of hydrogen can lead to a severe accident. It seems that today there is no real possibility to develop universal tools able to provide hydrogen safety at NPPs including normal operation and various accidents. However rather sophisticated systems for hydrogen monitoring and maintaining proper parameters of primary coolant circuit can be developed. The studies indicate that based on the similar type of electrochemical technique it is possible to create the system of complete monitoring of a coolant's state and its interaction with inner surfaces of the circuit. Measurements of hydrogen and oxygen concentration and pH play the most important role here and can solve practically all problems in coolant-core interaction.

456 (EUR–14039, pp. 247-260) **EPRI research on hydrogen combustion and control.** Haugh, J.J. (Electric Power Research Inst., Palo Alto, CA (United States)); Hosler, J.F.; Sliter, G.E.; Torok, R.C.; Wall, I.B. Commission of the European Communities, Luxembourg (Luxembourg). 1992. (CONF-9103264–: Proceedings of a Workshop on Hydrogen behaviour and mitigation in water-cooled nuclear power reactors, Brussels (Belgium), 4-8 Mar 1991). In *Hydrogen behaviour and mitigation in water-cooled nuclear power reactors.* 370p. Order Number DE93721166. Source: OSTI; NTIS (US Sales Only); INIS.

For several years, the nuclear industry has been concerned by the potential for hydrogen-air-steam mixtures to ignite and expose the containment and safety-related equipment to severe conditions. EPRI has executed a comprehensive program of experiments on hydrogen mixing and combustion, and equipment survivability and has demonstrated that deliberate ignition can control hydrogen during severe accidents and that safety-related equipment, satisfying USNRC criteria, has a high likelihood of remaining operable when exposed to such burns. The results have been used to benchmark new computer models for hydrogen mixing and combustion.

457 (EUR–14159) **The assessment of containment codes by experiments simulating severe accident scenarios.** Karwat, H. (Technische Univ. Muenchen (Germany)). Commission of the European Communities, Luxembourg (Luxembourg). 1992. 63p. Contract ETSN-0044-D(CH). Source: OSTI; NTIS (US Sales Only); INIS.

Hitherto, a generally applicable validation matrix for codes simulating the containment behaviour under severe accident conditions did not exist. Past code applications have shown that most problems may be traced back to inaccurate thermalhydraulic parameters governing gas- or aerosol-distribution events. A provisional code-validation matrix is proposed, based on a careful selection of containment experiments performed during recent years in relevant test facilities under various operating conditions. The matrix focuses on the thermalhydraulic aspects of the containment behaviour after severe accidents as a first important step. It may be supplemented in the future by additional suitable tests.

458 (EUR–14230) **A review of radionuclide release and transport in recent in-pile experiments.** Harman, N.F. (UKAEA Safety and Reliability Directorate, Culcheth (United Kingdom)); Clough, P.N. Commission of the European Communities, Luxembourg (Luxembourg). 1992. 115p. Contract ETNU-0018. Source: OSTI; NTIS (US Sales Only); INIS.

The experimental series, reviewed in this work, are LOFT-LP-FP-2, PBF SFD ST to 1-4, Treat/STEP I to 4, and ACRR ST-1 and ST-2. These have the common features of in-core heating of a test fuel bundle to high temperatures (usually with some fuel melting) in an experimental reactor core, and of collecting and analysing the released fission products. They were designed to provide detailed information on the release from fuel of fission products and other radionuclides under LWR severe accident conditions, and on the chemical and physical forms and transport of the fission products. The main aim of this review is to bring together, in a systematic way, information on the conduct of the tests, on their successes and failures, and particularly on the information they generated on the chemical and physical behaviour of released fission products. By examining and analysing the data from all of the tests together, patterns of fission product behaviour may become apparent and insights may be gained, which would not be arrived at from individual test results. Moreover, important lessons may be learned, and useful guidance obtained, relating to the aims and conduct of future experimental programmes of fission product release from fuel and transport behaviour. The conclusions should be particularly relevant to the imminent Phebus-FP in-pile test series at Cadarache.

459 (EUR–14363, pp. 37-45) **Pilot dismantling of the KRB A BWR at Gundremmingen. Phase 1 - Dismantling of contaminated and activated components.** Eickelpasch, N. (Kernkraftwerk-Betriebsgesellschaft mbH, Eggenstein-Leopoldshafen (Germany)); Stang, W.; Steiner, H. Commission of the European Communities, Luxembourg (Luxembourg). 1992. (CONF-9109441–: 2. Seminar on practical decommissioning experience with nuclear installations in the European Community, Sellafield (United Kingdom), 25-26 Sep 1991). In *Practical decommissioning experience with nuclear installations in the European Community.* 207p. Order Number DE93721081. Source: OSTI; NTIS (US Sales Only); INIS.

The nuclear power station Gundremmingen unit A (KRBA) was built from 1962 to 1966 as the first of three demonstration nuclear power stations in the Federal Republic of Germany and had an electrical output of 250 MW. In January 1977, the facility was placed out of operation due to an incident. In early 1980 it was decided to decommission the facility. The turbine building has been emptied by dismantling 4000 Mg of steel and concrete from 1983 until 1989. During the passed year the main decommissioning activities at the KRB plant have been: - dismantling and recycling of contaminated components in the reactor building - disassembly engineering of the reactor pressure vessel (RPV) and internals - development and test of special techniques, tools and machinery for decommissioning. All this dismantling works are covered by the

decommissioning license of 1983 and its supplement of 1989. Dismantling of the neutron-activated RPV internals and the biological shield are not yet licensed.

460 (INIS-mf–13348, pp. 11-14) **Overview of work on improving existing LWR core designs and developments for reactors of the next generation.** Abu-Zaied, G. (Paul Scherrer Inst. (PSI), Villigen (Switzerland)); Brogli, R. Paul Scherrer Inst. (PSI), Villigen (Switzerland). 1992. 74p. In *Paul Scherrer Institut annual report 1991: Annex IV: PSI nuclear energy research. Progress report 1991.* Order Number DE93000807. Source: OSTI; NTIS; INIS.

There is an interest in improving current reactors through minor and localized modifications to reactor system components. Improved safety and performance for current and future reactors is the main goal. The underlying motivation is to maintain the option for nuclear power in the future. It can be seen that significant improvements are potentially available through relatively minor modifications. Specific areas for improvement and an illustrative example are discussed in this paper. In this specific example, external assembly bypass water (an important moderator) was adjusted during normal operation to keep the reactor critical at hot full-power. It has been found that a reduction of about 10% in assembly average enrichment is achievable. Neither gadolinium nor control rods need to be used during normal operation. Reactivity coefficients (negativity) are increased. Great operational flexibility and core performance are promised but at the cost of a more complex control rod drive mechanism. (author) 2 figs., 7 refs.

461 (NUREG/CR–6003) **Density-wave instabilities in boiling water reactors.** March-Leuba, J. (Oak Ridge National Lab., TN (United States)). Nuclear Regulatory Commission, Washington, DC (United States). Div. of Systems Technology; Oak Ridge National Lab., TN (United States). Sep 1992. 45p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC05-84OR21400. (ORNL/TM–12130). Source: OSTI; NTIS; INIS; GPO.

This report contains a review of issues related to density-wave instabilities in boiling water reactors (BWRs). The report describes the types of instability modes that can be expected in operating reactors; these modes are: the channel thermohydraulic instability mode, the core-wide instability mode, and the out-of-phase instability mode. The physical mechanisms leading to each type of instability are reviewed and documented, along with some common mathematical models used in stability calculations is reviewed. The linear behavior of a BWR is studied through the use of transfer functions, and the nonlinear behavior and limit cycle development are studied. A summary of the sensitivities to physical parameters is also included in this report.

462 (VTT-TIED–1322) **Analysis of failure and maintenance experiences of motor operated valves in a Finnish nuclear power plant.** Simola, K. (Technical Research Centre of Finland, Espoo (Finland). Lab. of Electrical and Automation Engineering); Laakso, K. Technical Research Centre of Finland, Espoo (Finland). Jan 1992. 199p. Order Number DE93605780. Source: OSTI; NTIS; INIS.

Operating experiences from 1981 up to 1989 of totally 104 motor operated closing valves (MOV) in different safety systems at TVO I and II nuclear power units were analysed in a systematic way. The qualitative methods used were failure mode and effects analysis (FMEA) and maintenance effects and criticality analysis (MECA). The failure descriptions were obtained from power plant's computerized failure reporting system. The reported 181 failure events were reanalysed and sorted according to specific classifications developed for the MOV function. Filled FMEA and MECA sheets on individual valves were stored in a microcomputer data base for further analyses. Analyses were performed for the failed mechanical and electrical valve parts, ways of detection of failure modes, failure effects, and repair and unavailability times.

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Refer also to citation(s) 443, 444, 445, 446, 447, 448, 449, 450, 451, 452, 453, 454, 455, 456, 457, 458, 494, 540, 579, 591, 612, 708, 717, 718, 719, 720, 721, 725

463 (AECL–10390) **Synergistic CANDU-LWR fuel cycles.** Hastings, I.J. (Atomic Energy of Canada Ltd., Chalk River, ON (Canada). Chalk River Nuclear Labs.); Boczar, P.G.; Allan, C.J.; Gacesa, M. Atomic Energy of Canada Ltd., Chalk River, ON (Canada). Chalk River Nuclear Labs. May 1991. 12p. (CONF-9104386–: 6. Korea Atomic Industrial Forum/Korea Nuclear Society (KAIF/KNS) joint annual conference, Seoul (Korea, Republic of), 15 Apr 1991). Order Number DE93603864. Source: OSTI; NTIS (US Sales Only); INIS.

CANDU is the most neutron-efficient reactor available commercially, allowing utilization of a range of fuel cycles. The flexibility of on-line refuelling allows fuel management to accommodate these different fuels. A synergism with light-water reactors (LWR) is possible through the use in CANDU of uranium and/or plutonium recovered from spent LWR fuel. In the TANDEM fuel cycle, the unseparated uranium and plutonium (1.5% fissile) would give a burnup in CANDU of about 25 MW.d/kg HE, producing four times more energy than that available from simply recycling the plutonium in an LWR. In another potential fuel cycle, uranium recovered from spent LWR fuel during conventional reprocessing is also recycled in CANDU, without re-enrichment. An average recovered uranium (RU) enrichment of 0.9% in U-235 results in a CANDU burnup of at least 13 MW.d/kg U, allowing twice as much energy to be extracted, compared with that from an LWR. The fuelling cost for RU in CANDU are about 35% lower than for natural uranium. Additionally, direct use of spent LWR fuel in CANDU is theoretically possible, but requires practical demonstration. AECL and KAERI are developing the CANFLEX (CANDU Flexible Fuelling) advanced fuel bundle as the optimal carrier for all extended burnup fuel cycles envisaged for CANDU.

464 (CEA-CONF–10942) **Decision aid systems for nuclear reactors.** Evrard, J.M.; Martinez, J.M. CEA Centre d'Etudes de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Mecanique et de Technologie. 1992. 9p. (In French). (CONF-9203196–: INFAUTON 92: Operational expert systems, Toulouse (France), 12-13 Mar 1992). Order Number DE93721162. Source: OSTI; NTIS (US Sales Only); INIS.

The development of new techniques, especially in the field of artificial intelligence, makes it possible to design more powerful computerized systems, supporting tasks related to the design and operation of nuclear power plants. The potential contribution and perspectives for the integration of such systems depend upon whether the improvement of existing plants, the design of next generation reactors or future projects are concerned. We present four systems which show the state-of-the-art as regards knowledge-based systems. The first system is related to the automatic generation of procedures dealing with loss of electrical sources. The second one aims at assisting the power plant utility in following the technical specifications during maintenance operations. Finally, the last two are designed to help an emergency team evaluate and forecast the evolution of an accidental situation in a nuclear reactor. Perspectives for on-line operator assistance are then discussed, as well as the main technical themes which will make it possible to design such systems. We conclude with the difficulties which are encountered upon the integration of these tools: their validation and task sharing between man and machine.

465 (CEA-CONF–10968) **Three basic options for the management of PWR waste.** Malherbe, J. (CEA Centre d'Etudes de la Vallee du Rhone, 30 - Marcoule (France). Dept. des Procedes de Retraitement); Santraille, S.; Saulieu, E. de; Glibert, R.; Alamo Berna, S.; Cecille, L.; Geiser, H.; Kowa, S.; Thiels, G. CEA Centre d'Etudes de la Vallee du Rhone, 30 - Marcoule (France). Dept. des Procedes de Retraitement. 1990. 14p. (CONF-9009208–: 3. European community conference on radioactive waste management and disposal, Luxembourg (Luxembourg), 17-21 Sep 1990). Order Number DE93721211. Source: OSTI; NTIS (US Sales Only); INIS.

Relying on the national practices of France, Germany and Belgium, three reference management routes for PWR wastes were drawn up and subsequently evaluated in terms of costs and radiological impact. It was thus demonstrated that safety regulations and technical redundancies, especially for off-gas treatment, liquid waste processing and dry solid waste treatment, play an important part in the cost associated with each route. The analysis of the different treatment options for mixed solid low level waste highlighted the low cost effectiveness of incineration as compared to compaction. Whatever the scenario investigated, the disposal costs of PWR wastes proved to be quite marginal in the overall cost. The radiological impact associated with each route was assessed through individual doses resulting from liquid and gaseous effluents. This theoretical exercise included some sensitivity studies performed on a selection of important parameters.

466 (CONF-9210173–1) **Needs for evaluated covariance data for reactor pressure vessel dosimetry.** Maerker, R.E. (Oak Ridge National Lab., TN (United States)); Broadhead, B.L.; Wagschal, J.J. Oak Ridge National Lab., TN (United States). [1992]. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Nuclear Energy Agency Science Committee (NEANSC) specialists meeting on evaluation and processing of covariance data; Oak Ridge, TN (United States); 7-9 Oct 1992. Order Number DE93000452. Source: OSTI; NTIS; INIS; GPO Dep.

This report discusses new methodology for quantifying and then reducing uncertainties in the calculated pressure vessel fluences of a pressurized water reactor (PWR). The technique involves combining the integral results of the calculated and measured PWR surveillance dosimetry activities with the differential data used in the calculations, along with covariances of all the quantities, into a generalized linear least-squares adjustment procedure. Based on analysis of both PWRs and test reactor benchmarks, substantial evidence now exists to support the conclusion that, of all the nuclear as well as non-nuclear differential data considered, ENDF/B-VI values of the total inelastic iron cross sections and their covariances are the most important data controlling the outcome of the adjustment procedure. Predicted adjustments in these cross sections provided the stimulus for new measurements, the results of which impacted the ENDF/B-VI evaluation of iron 56.

467 (DOE/ER/12809–2) **The slightly-enriched spectral shift control reactor: Progress report, June 1, 1989–May 31, 1990.** Martin, W.R. (Michigan Univ., Ann Arbor, MI (United States). Dept. of Nuclear Engineering); Lee, J.C.; Edlund, M.C. Michigan Univ., Ann Arbor, MI (United States). Dept. of Nuclear Engineering. Jun 1990. 62p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG07-88ER12809. Order Number DE92040987. Source: OSTI; NTIS; INIS; GPO Dep.

An advanced converter reactor design utilizing mechanical spectral shift control rods in a conventional pressurized water reactor configuration is under investigation. The design is based on the principle that a harder spectrum during the early part of the fuel cycle will result in larger neutron captures in fertile ^{238}U, which can then be burned in situ in a softer spectrum later in the cycle. Preliminary design calculations performed during FY 89 show that the slightly-enriched spectral shift reactor design offers the benefit of substantially increased fuel resource utilization with the proven safety characteristics of the pressurized water reactor technology retained. Optimization of the fuel design and development of fuel management strategies have been carried out in FY 90, along with effort to develop and validate neutronic methodology for tight-lattice configurations with hard spectra. During FY 91, the final year of the grant, effort will focus on performing the final design calculations and continuing the research to develop improved methods for tight lattice analysis.

468 (EUR–14039, pp. 16-27) **Hydrogen production limits under PWR degraded core conditions: the status of current modelling capabilities and plant predictions.** Lillington, J.N. (UKAEA Atomic Energy Establishment, Winfrith (United Kingdom)). Commission of the European Communities, Luxembourg (Luxembourg). 1992. (CONF-9103264–: Proceedings of a Workshop on Hydrogen behaviour and mitigation in water-cooled nuclear power reactors, Brussels (Belgium), 4-8 Mar 1991). In *Hydrogen behaviour and mitigation in water-cooled nuclear power reactors.* 370p. Order Number DE93721166. Source: OSTI; NTIS (US Sales Only); INIS.

This paper gives the state-of-the-art knowledge on early phase hydrogen production during in-vessel core heat-up. The key phenomena affecting hydrogen production are discussed, together with the status of current modelling capabilities. Predictions from selected plant calculations are given, ranging from code calculations incorporating simple models (e.g. 1-D thermal-hydraulics, non-mechanistic melt progression) through to code calculations incorporating the latest detailed models (natural circulation, mechanistic melt progression). Much of the analysis carried out to date has been for intact circuit transients. Although, in this paper, emphasis is placed on this scenario, other sequences are also briefly mentioned. The main conclusions are that among the code calculations there is reasonable agreement on the percentage of Zircaloy reacted prior to cladding melting and relocation, typically 10-20% of the available Zircaloy. Predictions of the total Zircaloy reacted in-vessel typically vary in the range 25-50%. The differences between the extremes, are largely due to modelling assumptions made on melt progression and steam diversion at the blockage.

469 (EUR–14039, pp. 38-49) **Experimental results of the large-scale HDR hydrogen-mixing experiments E11.2 and E11.4.** Valencia, L.A. (Kernforschungszentrum Karlsruhe GmbH (Germany)); Wolf, L. Commission of the European Communities, Luxembourg (Luxembourg). 1992. (CONF-9103264–: Proceedings of a Workshop on Hydrogen behaviour and mitigation in water-cooled nuclear power reactors, Brussels (Belgium), 4-8 Mar 1991). In *Hydrogen behaviour and mitigation in water-cooled nuclear power reactors.* 370p. Order Number DE93721166. Source: OSTI; NTIS (US Sales Only); INIS.

The E11 tests series covered a combination of important issues dominating the physical phenomena controlling the hydrogen distribution mechanisms, namely: large-scale, multi-compartment, geometry with large-sized dome volume, high gas release rates, multiple steam and gas injection phases at different axial positions and examinations of the efficiencies of mitigative system features including the impact of external sprays at the top of the dome.

470 (EUR–14039, pp. 65-73) **Hydrogen distribution experiments for Loviisa ice condenser containment.** Hongisto, O. (Imatran Voima Oy (IVO), Helsinki (Finland)); Tuomisto, H.; Lundstroem, P. Commission of the European Communities, Luxembourg (Luxembourg). 1992. (CONF-9103264–: Proceedings of a Workshop on Hydrogen behaviour and mitigation in water-cooled nuclear power reactors, Brussels (Belgium), 4-8 Mar 1991). In *Hydrogen behaviour and mitigation in water-cooled nuclear power reactors.* 370p. Order Number DE93721166. Source: OSTI; NTIS (US Sales Only); INIS.

An experimental facility has been constructed for studying the Loviisa ice condenser containment thermal-hydraulics during small-break LOCAs and severe accidents. The facility is a scale model of the Loviisa containment with linear scaling 1:15 and volume scaling 1:3375. The experimental program includes three phases: influence of the ice condenser on the containment behavior during SBLOCAs, long-term behavior of the facility during small steam releases, and hydrogen distribution during core degradation accidents. Experiments have been started in December 1990. The results of preliminary experiments already indicate that stratification and separation phenomena will have a significant contribution to the hydrogen distribution.

471 (EUR–14039, pp. 96-101) **Proving test on the reliability for reactor containment vessel hydrogen mixing and distribution test.** Takumi, K. (Nuclear Power Engineering Workshop, Tokyo (Japan)); Nonaka, A.; Ogata, J.; Moriya, K. Commission of the European Communities, Luxembourg (Luxembourg). 1992. (CONF-9103264–: Proceedings of a Workshop on Hydrogen behaviour and mitigation in water-cooled nuclear power reactors, Brussels (Belgium), 4-8 Mar 1991). In *Hydrogen behaviour and mitigation in water-cooled nuclear power reactors.* 370p. Order Number DE93721166. Source: OSTI; NTIS (US Sales Only); INIS.

Hydrogen mixing and distribution test has been performed at Tadotsu Engineering Laboratory of NUPEC. Some of the test results show that hydrogen is well mixed generally in a containment vessel.

472 (EUR–14039, pp. 102-113) **Use of the Jericho code for the assessment of thermalhydraulics and hydrogen behaviour in nuclear power plant containment.** L'Heriteau, J.P. (CEA Centre d'Etudes de Fontenay-aux-Roses, 92 (France)). Commission of the European Communities, Luxembourg (Luxembourg). 1992. (CONF-9103264–: Proceedings of a Workshop on Hydrogen behaviour and mitigation in water-cooled nuclear power reactors, Brussels (Belgium), 4-8 Mar 1991). In *Hydrogen behaviour and mitigation in water-cooled nuclear power reactors.* 370p. Order Number DE93721166. Source: OSTI; NTIS (US Sales Only); INIS.

This paper describes the JERICHO code and gives examples of its use in term of analysis of hydrogen behaviour in large dry PWR containments. The first part gives a brief description of physical models linked to hydrogen behaviour, the second part gives the principal results obtained with the JERICHO code in the benchmark exercise DEMONA F2 sponsored by the CEE; the last part is focused on the problem of postinerting a large dry 900 MWe type containment.

473 (EUR–14039, pp. 202-206) **Hydrogen mitigation technical means of nuclear power plants.** Baronov, G.S. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (Russian Federation). Inst. Atomnoj Ehnergii); Davidov, Y.G.; Ershov, D.E.; Furkasov, D.E.; Kalinnikov, A.A.; Keller, V.D. Commission of the European Communities, Luxembourg (Luxembourg). 1992. (CONF-9103264–: Proceedings of a Workshop on Hydrogen behaviour and mitigation in water-cooled nuclear power reactors, Brussels (Belgium), 4-8 Mar 1991). In *Hydrogen behaviour and mitigation in water-cooled nuclear power reactors.* 370p. Order Number DE93721166. Source: OSTI; NTIS (US Sales Only); INIS.

Concept of employment on light water reactor hydrogen mitigation system, which include hydrogen sensors and recombiners, are considered. Principles of modified thermocatalytical hydrogen sensor is described. It can function in a wide temperature and pressure range and at considerable variation of analyzed mixture composition, including hydrogen, steam, helium, air. Modification of hydrogen recombiner, based on platinum activated high porosity cell materials (HPCM), is investigated by experimentally and theoretically. High penetracity and sufficiently developed surface of HPCM allow to use the natural convection for effective hydrogen recombination by sufficiently small volumes of HPCM. Recombiner design and peculiarity of physical-chemical processes inside recombiner cause security against detonation initiation.

474 (EUR–14039, pp. 224-239) **Mitigation of hydrogen threats to large dry containments (German approach).** Rohde, J. (Gesellschaft fuer Reaktorsicherheit mbH (GRS), Koeln (Germany)); Chakraborty, A.K.; Huettermann, B. Commission of the European Communities, Luxembourg (Luxembourg). 1992. (CONF-9103264–: Proceedings of a Workshop on Hydrogen behaviour and mitigation in water-cooled nuclear power reactors, Brussels (Belgium), 4-8 Mar 1991). In *Hydrogen behaviour and mitigation in water-cooled nuclear power reactors.* 370p. Order Number DE93721166. Source: OSTI; NTIS (US Sales Only); INIS.

A large amount of hydrogen is expected to be released within a large dry containment of a PWR shortly after the onset of a core melt accident. At first, the relevant accident scenarios leading to core melt and the probability of their occurrences have been discussed. Calculations of the hydrogen generation due to zircaloy-steam reaction and the reaction of molten core material with concrete and the local and global gasdistribution have revealed that the hydrogen concentration can enrich locally to an extent to pose a threat to the integrity of the containment. Several concepts of mitigation have been developed to limit the hydrogen concentrations and the use of deliberate ignition as well as of catalytic removal of hydrogen have been mainly addressed in this paper. In order to derive the maximum advantages of removing hydrogen a combined application of both using deliberate ignition and catalytic removal has been contemplated as 'dual-concept'. Finally the present status of counter measures in the FRG against this threat has also been reviewed.

475 (EUR–14039, pp. 261-273) **Critical review on hydrogen mitigation by ignitors for large dry PWR containments.** Karwat, H. (Technische Univ. Muenchen (Germany). Lehrstuhl fuer Reaktordynamik und Reaktorsicherheit). Commission of the European Communities, Luxembourg (Luxembourg). 1992. (CONF-9103264–: Proceedings of a Workshop on Hydrogen behaviour and mitigation in water-cooled nuclear power reactors, Brussels (Belgium), 4-8 Mar 1991). In *Hydrogen behaviour and mitigation in water-cooled nuclear power reactors.* 370p. Order Number DE93721166. Source: OSTI; NTIS (US Sales Only); INIS.

Hydrogen release during severe accidents poses a serious threat to the containment integrity. Mitigating procedures are necessary to prevent global or local explosions, in particular for large dry steel shell containments. A number of unresolved problems exist presently not allowing a credible prediction of the benefit of the installation of ignitors proposed for some containments. Neither are hydrogen generation rates nor the gas distribution on or the combustion processes predictable with reasonable reliability to prove the benefits and/or exclude negative consequences of the application of ignitors.

476 (EUR–14039, pp. 297-304) **Catalytic recombination systems for severe accidents and noised-induced ignition to detonation transition effect.** Kirillov, I.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (Russian Federation). Inst. Atomnoj Ehnergii); Rusanov, V.D.; Fridman, A.A. Commission of the European Communities, Luxembourg (Luxembourg). 1992. (CONF-9103264–: Proceedings of a Workshop on Hydrogen behaviour and mitigation in water-cooled nuclear power reactors, Brussels (Belgium), 4-8 Mar 1991). In *Hydrogen behaviour and mitigation in water-cooled nuclear power reactors.* 370p. Order Number DE93721166. Source: OSTI; NTIS (US Sales Only); INIS.

Contemporary deliberate ignition systems (DIS) for hydrogen removal out of containment have several intrinsic drawbacks and weakness. In order to avoid these difficulties the physical principles of the controlled recombination systems (CRS), oriented to achieve the 'inherent safety' level, were formulated. It was proposed for the elaboration of the prototype of CRS to use a catalytic recombiners (on either porous or compact supports), whose structure on macroscopic level provides spatially uniform hydrogen recombination inside containment and on mesoscopic level excludes the transition from recombination to ignition regime. Special attention is focused on safety operation of the hydrogen mitigation scheme in post-accident containment atmosphere. It was shown that the modulational instability of the small amplitude external disturbances in a sufficiently extended initially homogeneous induction zone can result in formation of the 'hot spots'. A minimal threshold value of induction zone size and its dependence on temperature disturbances was evaluated. Onset and evolution of a weak discontinuity in a spontaneous propagation of chemical reaction zone was investigated analytically. Criterion for a shock wave formation was received. It is emphasized that scaling of hydrogen catalytic recombination systems (both under development and any advanced) should be done with taking into account the different mechanisms of spontaneous transition to detonation, induced by small amplitude disturbances in the distributed induction zone.

477 (EUR–14039, pp. 324-332) **Some aspects of hydrogen catalytic recombiner operation under severe accident conditions.** Grigoriev, S. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (Russian Federation). Inst. Atomnoj Ehnergii); Davidov, Y.; Stolyarova, G.; Khodulev, L. Commission of the European Communities, Luxembourg (Luxembourg). 1992. (CONF-9103264–: Proceedings of a Workshop on Hydrogen behaviour and mitigation in water-cooled nuclear power reactors, Brussels (Belgium), 4-8 Mar 1991). In *Hydrogen behaviour and mitigation in water-cooled nuclear power reactors.* 370p. Order Number DE93721166. Source: OSTI; NTIS (US Sales Only); INIS.

The paper is addressed to the problem of operation of hydrogen catalytic recombiner based on high-porosity cell material under severe accident conditions at NPP with a nuclear reactor of VVER-type. Chemical composition and radiation-chemical kinetics of containment atmosphere, required recombiner capacity for various accident scenarios and, finally, gasdynamics of hydrogen oxidation process in the recombiner are of particular interest in this paper.

478 (EUR–14039, pp. 333-342) **Hydrogen behaviour in VVER - 440 nuclear power plants in case of severe accidents.** Techy, Z.; Lajtha, G. Commission of the European Communities,

Luxembourg (Luxembourg). 1992. (CONF-9103264–: Proceedings of a Workshop on Hydrogen behaviour and mitigation in water-cooled nuclear power reactors, Brussels (Belgium), 4-8 Mar 1991). In *Hydrogen behaviour and mitigation in water-cooled nuclear power reactors.* 370p. Order Number DE93721166. Source: OSTI; NTIS (US Sales Only); INIS.

We have performed calculations for three severe accident sequences of the VVER - 440 plant: small break LOCA with loss of offsite and onsite power (S2B), transient with station blackout (TMLB), and small break LOCA with ECC inoperability (S2D). The calculations have been accomplished by the Source Term Code Package (STCP), modified for VVER reactor applications. Containment integrity is jeopardized mainly by the hydrogen evolved in large amounts from the zirconium reaction during the ex-vessel core-concrete interaction. Intense pressure spikes resulting from hydrogen deflagrations for the S2B and TMLB sequences may damage the containment. Operation of containment sprays in the S2D sequence leads to a series of deflagrations with smaller intensity. Overpressurization resulting from heat generation and release of steam and gases do not threaten containment integrity for prolonged time periods.

479 (EUR–14039, pp. 343-355) **A strategy for hydrogen risks in WWER nuclear power plants.** Fineschi, F. (Pisa Univ. (Italy). Dipt. di Costruzioni Meccaniche e Nucleari). Commission of the European Communities, Luxembourg (Luxembourg). 1992. (CONF-9103264–: Proceedings of a Workshop on Hydrogen behaviour and mitigation in water-cooled nuclear power reactors, Brussels (Belgium), 4-8 Mar 1991). In *Hydrogen behaviour and mitigation in water-cooled nuclear power reactors.* 370p. Order Number DE93721166. Source: OSTI; NTIS (US Sales Only); INIS.

There are three danger levels related to the combustion of the hydrogen which is generated and released in the reactor containment during a loss of coolant accident in a water-cooled nuclear power plant. A strategy to deal with hydrogen risks should be based on three main rules related to the 'defense in depth' concept. This analysis compares the impact that different designs of containment systems have on the hydrogen problem in WWER plants built in Eastern Europe. A comparison with Western nuclear plants is made to favour international co-operation for the solution of the hydrogen problem in existing plants, wherever they may be. In WWERs, complete pre-inerting is impossible and post-inerting entails an expensive filtered venting. Recombiners have to be installed in all plants to avoid deflagrations as far as possible. In WWERs-1000 a deliberate ignition system could be installed in addition to recombiners, while in WWERs-440 deliberate ignition could even be detrimental.

480 (EUR–14363, pp. 25-36) **The BR3 pressurized water reactor pilot dismantling project. Chemical decontamination of the primary loop development and commissioning of equipment for the segmenting of the reactor internals.** Motte, F. (Centre d'Etude de l'Energie Nucleaire, Mol (Belgium)); Klein, M.; Massaut, V.; Bourdelet, M.; Saumon, P.; Lefebvre, A.; Scholl, K.; Wille, H.; Operschall, H. Commission of the European Communities, Luxembourg (Luxembourg). 1992. (CONF-9109441–: 2. Seminar on practical decommissioning experience with nuclear installations in the European Community, Sellafield (United Kingdom), 25-26 Sep 1991). In *Practical decommissioning experience with nuclear installations in the European Community.* 207p. Order Number DE93721081. Source: OSTI; NTIS (US Sales Only); INIS.

The decontamination of the primary loop has been performed in 1991 using the CORD process. Three decontamination cycles were performed. Each cycle comprises an oxidation step with permanganic acid, a reduction decontamination step with oxalic acid with the fixation of the activity on ion exchange beds and finally a cleaning step. Gamma radiation dose rate are measured before and after decontamination, using thermoluminescent detectors. For segmenting the BR3 reactor internals, especially the thermal shield, three methods have been selected and the corresponding equipment has been developed: mechanical sawing, electrodischarge machining and plasma arc cutting. Preliminary cold tests are compared for these three methods.

481 (INIS-BR–2942, pp. 96-97) **Ovalization and structural integrity of the zone 10 of the Angra-2 reactor pressure vessel. Part I: non-linear material analysis. Part II: non-linear material and geometric analysis.** Correia Filho, A. (Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores); Goncalves Filho, O.J.A. Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1989. 147p. (In Portuguese). In *Triennial technical report - 1986, 1987, 1988 - Instituto de Engenharia Nuclear (IEN) -Dept. of Reactors (DERE).* Order Number DE93605069. Source: OSTI; NTIS (US Sales Only); INIS.

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Published in summary form only. ANGRA-2 REACTOR/pressure vessels; PRESSURE VESSELS/deformation; PRESSURE VESSELS/plasticity; E CODES; FINITE ELEMENT METHOD; MATHEMATICAL MODELS; NONLINEAR PROBLEMS; DEFORMATION; PLASTICITY

482 (INIS-mf–13349, pp. 11-12) **Application of probabilistic safety assessment procedure to investigate the reliability of bushher nuclear power plant in case of outages in electric power supply network.** Sepanloo, K. (Atomic Energy Organization of Iran, Tehran (Iran). Safety System Div.); Ghofrani, M.B.; Afshar Bekeshloo, A.; Tochaie, M.T. Iranian Physics Society, Teheran (Iran, Islamic Republic of). 1991. 53p. (In Persian). (CONF-9109417–: Iran's physics conference, Isfahan (Iran, Islamic Republic of), 10 Sep 1991). In *Abstract of articles from Iran's physics conference.* Order Number DE93000811. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. PROBABILISTIC ESTIMATION/pwr type reactors; ELECTRIC POWER; FAILURE MODE ANALYSIS; IRAN-1 REACTOR; OUTAGES; POWER SUPPLIES; RELIABILITY

483 (KAERI/RR–934/91) **Development of design technology for an advanced pressurized water reactor: Improvements of the reactor coolant system.** Kim, Dong Soo (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Chang, Won Pyo; Park, Koon Chul. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Jul 1991. 167p. (In Korean). Order Number DE93605786. Source: OSTI; NTIS (US Sales Only); INIS.

The objective of the project is to localize technology for the improvement of the reactor coolant system through a multidimensional thermal-hydraulic analysis for the steam generator and the pressurizer. Flow distribution analysis has been done for the YGN 3/4 steam generators when steady-state output conditions were varied in the ranges such as 100, 75, 50, and 25 using three-dimensional ATHOS 3 code. The results of the thermal-hydraulic analysis have been used for flow-induced vibration analysis for the YGN 3/4 steam generators. ATHOS 3 code has been modified for YGN 3/4 steam generator tube lane region using the cartesian geometry and the local porosity in the boundaries of the two adjacent cells. Stability ratio for the tube vibration has been calculated the modified ATHOS 3 and ANSYS code. A sensitivity study for the pressurizer volume change has been analyzed using LTC code which is for the performance analysis to predict an optimistic pressurizer volume. (Author).

484 (KAERI/RR–1013/91) **Development of design technology for advanced pressurized water reactor: A feasible study for the passive reactor development.** Kim, Si Hwan (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Chang, Moon Hee; Lee, Jong Chul. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Aug 1991. 541p. (In Korean). Order Number DE93605782. Source: OSTI; NTIS (US Sales Only); INIS.

In order to investigate the feasibility of the domestic passive reactor development, the analysis and evaluation on the development status, technical characteristics, and the safety and economy for the overseas passive reactors were carried out based on the vendor's information. Also the domestic nuclear technology basis was surveyed. The analysis and evaluation of the development status and technical characteristics were performed mainly for the AP-600 developed by Westing house and the SIR of UKAEA. The new design concepts and system characteristics have been evaluated by utilizing EPRI Utility Requirement Documents and Lahmeyer evaluation criteria. Based on this evaluation the recommendable design concepts in each major system were selected. The feasibility for the domestic passive reactor development has focused on the safety, technology and economy aspects, and on the applicability

of the existing domestic technology to the design of the passive reactor. And the development plan for the domestic passive reactor was recommended in a step by step way. (Author).

485 (KAERI/RR–1023/90) **A study on severe accidents of nuclear power plants.** Park, Chang Kyu (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Chae, Sung Ki; Cho, Sung Won. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Sep 1991. 334p. (In Korean). Order Number DE93605783. Source: OSTI; NTIS (US Sales Only); INIS.

The severe accident analysis computer codes, such as SCDAP/RELAP5, CONTAIN and MELCOR are installed on a SUN workstation. This resulted in reducing the amount of computing cost and eliminating the inconvenience due to use of large computer system. The user's guide of SCDAP/RELAP5 and CONTAIN codes were prepared for easy use of these codes. As a phenomenological study in severe accidents, hydrogen burn models adapted in the HECTR and MAAP computer codes have been examined. Also, the effect of the non-condensible gases on natural circulation was investigated using SCDAP/RELAP5. V-sequence in YGN 3 and 4 was assessed using STCP. The amount of radioactive fission product release to the environment in this sequence is rather large since it is released via auxiliary building. As a first step to develop on accident management methodology, several accident management strategies were reviewed. Especially, coolability of the degraded core was investigated. Scaling model law for DCH was developed. Standard cavity which can minimize the effect of DCH was designed. (Author).

486 (KAERI/RR–1030/91) **Experimental research on pressurized water reactor(PWR) safety.** Kim, Dong Su (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Chae, Sung Ki; Chang, Won Pyo. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Dec 1991. 257p. (In Korean). Order Number DE93605784. Source: OSTI; NTIS (US Sales Only); INIS.

The objective of this research is to analyze the experimental results already performed in BETHSY facility of CEA France and to establish essential technologies for the future implementation of both such an experiment and computer code assessment, which are not undergoing in Korea so far. The contents of the present study are divided into 2 categories; namely, analysis of the BETHSY experimental data received from CEA, and CATHARE computer code simulation for the selected experiments, i.e. 'Natural Circulation(Test 4.3a)' and '2 Cold Leg Break'. The later studies are performed under the aims of CATHARE assessment as well as qualification of KOSAC code developing at KAERI, which is the subject in the next year and will concern an adequacy of KOSAC for the prediction of low flow natural circulation and a small break transients. (Author).

487 (KAERI/RR–1063/91) **Development of nuclear district heating reactor.** Moon, Kap Suk (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Kwack, Eun Ho; Sur, Uk Hwan. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Jan 1991. 225p. (In Korean). Order Number DE93605785. Source: OSTI; NTIS (US Sales Only); INIS.

The growth of the heating load over the 2000s can give rise to the limitation of fossil fuels and causes increased pollution so that an ecosystem destruction will be felt more and more serious. Such characteristics indicate a need for a nuclear energy. The objectives of the project are to establish the design concepts and study the technical and economic feasibility for development and construction of a Nuclear District Heating Reactor (NDHR) with passive/inherent safety concept at KAERI site. The pool-type was determined for NDHR based on understanding the development status and NDHR concepts from various countries and estimating safety, technical and economic features for the NDHR. It is recommended that the development and construction of the NDHR should be carried out only after establishment of a suitable utilization plan for the NDHR by taking into account upcoming problems such as compatibility with the existing facility in KAERI, practical application and commercial use of the NDHR afterward. (Author).

488 (KAERI/RR–1069/91) **Study on computerization of PWR secondary side chemistry monitoring.** Yang, Kyung Rin (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Hong, Kwang Bum; Lee, Eun Hee. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Jan 1991. 70p. (In Korean). Order Number DE93605446. Source: OSTI; NTIS (US Sales Only); INIS.

A computer program for on-line chemistry monitoring system which located in secondary side of PWR plant is under developing. 500A measurement and control system is used for data acquisition and control and scientific and engineering software package of ASYST is used for developing software program. The contents of two computer programs which developed until now are as follows; (1). Data Acquisition and Real-Time Display : The output signals of monitoring chemical sensors are stored in PC showing real-time display. When signal is over the action level, alarm is generated and data acquisition is terminated. (2). Data Management and Trending Graphs : The data stored in PC are output in various graphic mode for data management such as simple trending graphs screen display, time duration plot and histogram plot. (Author).

489 (UJV–9670-R) **A result of the WWER-1000 benchmark: The core level calculation.** Vrba, L. Ustav Jaderneho Vyzkumu CSKAE, Rez (Czechoslovakia). May 1992. 28p. Order Number DE93605787. Source: OSTI; NTIS (US Sales Only); INIS.

A calculation of the core level part of the IAEA WWER-1000 benchmark (Kalinin NPP, Unit 1, Cycles 1-6) was performed using the BIPR-6 code. In the calculation, input data proposed by the KASSETA code in Energoprojekt, Prague were used. Calculated critical boron concentrations and the power distributions, both axial and over assemblies, are tabulated for cycles 1-6. (Z.S.) 19 tabs., 7 figs., 6 refs.

490 (UJV–9685-R,D) **Investigations for WWER reactor pressure vessel neutron exposure evaluation in CSFR.** Osmera, B. Ustav Jaderneho Vyzkumu CSKAE, Rez (Czechoslovakia). Jun 1992. 34p. Order Number DE93605788. Source: OSTI; NTIS (US Sales Only); INIS.

The self-consistent results of WWER-440 reactor pressure vessel monitoring correspond to the mockup methodology. The calculations underestimate the density of neutron flux impinging on the pressure vessel inner wall in comparison with the experimental data evaluated by means of the mockup. In results adopted for reactor pressure vessel dosimetry, the effects of the displacer (effective decreasing of the water density in the mockup) and of air gaps on measurements over the pressure vessel thickness were neglected. The influence of the LR-0 tank (16 mm thick aluminium vessel) was disregarded, it was also estimated by experiment. In the mockups of WWER-1000 geometry a background of albedo neutrons was found. The effect was suppressed using a thick axial reflector. (author) 12 figs., 5 tabs., 9 refs.

2103 Power Reactors, Nonbreeding, Graphite Moderated

Refer also to citation(s) 464, 1471

491 (EUR–14363, pp. 11-23) **Pilot dismantling of the Windscale advanced gas-cooled reactor - phase 1: dismantling of the refuelling stand pipes and RPV top dome.** Taylor, E. (AEA Decommissioning and Radwaste, Windscale (GB)); Sloan, P. Commission of the European Communities, Luxembourg (Luxembourg). 1992. (CONF-9109441–: 2. Seminar on practical decommissioning experience with nuclear installations in the European Community, Sellafield (United Kingdom), 25-26 Sep 1991). In *Practical decommissioning experience with nuclear installations in the European Community.* 207p. Order Number DE93721081. Source: OSTI; NTIS (US Sales Only); INIS.

Large scale dismantling began in 1989 by dismantling the reactor refuelling machine weighing some 470 tons. Parts of this machine were utilised as a heavy lifting frame for the removal of the reactor top biological shield, a 60 tons steel and concrete structure. The top biological shield was subsequently size reduced using thermic lancing in a temporary containment constructed on the reactor refuelling floor. Since 1990 the two major operations have been to remove the reactor pressure vessel top dome and cut the refuelling stand pipes thus exposed inside the RPV, down

to the level of the reactor hot box. Operation is described and dose uptake estimated.

492 (EUR–14363, pp. 81-93) **Remote dismantling experience at Windscale pile chimneys and other AEA/BNFL facilities.** Wright, E.M. (British Nuclear Fuels plc, Sellafield (United Kingdom)); Jones, E.L.; Leng, J.H. Commission of the European Communities, Luxembourg (Luxembourg). 1992. (CONF-9109441–: 2. Seminar on practical decommissioning experience with nuclear installations in the European Community, Sellafield (United Kingdom), 25-26 Sep 1991). In *Practical decommissioning experience with nuclear installations in the European Community*. 207p. Order Number DE93721081. Source: OSTI; NTIS (US Sales Only); INIS.

This paper described recent remote dismantling experience at British Nuclear Fuels Ltd and at AEA Technology. Three areas are considered, firstly transfer of proven technology from non-nuclear industries, aimed at ensuring low commercial risk where tasks are relatively simple and radiation levels permit some human intervention. Work on dismantling the Windscale Pile Chimneys falls into this category. Secondly the equipment developed to support the decommissioning of the Windscale Advanced Gas Cooled Reactor is discussed. Finally a summary is given of the systems developed to cut, divert and weld a highly active raffinate line and to recover fuel rods within the Sellafield Magnox Reprocessing Plant.

493 (Juel–2585) **Studies on transferring the safety features of the module reactor to a large power reactor.** Sun Yuliang. Forschungszentrum Juelich GmbH (Germany). Inst. fuer Sicherheitsforschung und Reaktortechnik; Technische Hochschule Aachen (Germany). Feb 1992. 112p. (In German). Order Number DE93720185. Source: OSTI; NTIS (US Sales Only); INIS.

The German industries and research institutions have developed the HTR module reactor, which is strongly characterized by inherent safety features. The power output is limited to about 200 MWth because of its core configuration. It has been investigated in this work, whether the safety features of the module reactor can be transferred to larger power reactors. For this purpose the conceptual design of a ring core pebble bed reactor has been made with a thermal power output of 3000 MW. By means of computer calculations, the principal physical, thermohydraulical and safety features of the ring reactor have been studied. It has been shown that the 3000-MWth ring reactor basically possesses the same safety characteristics as the small module reactor. At reactivity disturbances, the reactor is shut down passively by the strongly negative temperature coefficient. The decay heat removal is also realized based on the passive priniciple. In the case of a total loss of coolant, the maximum fuel element temperature remains below 1600deg C; and consequently the retention of fission products in the fuel elements is fully attained. The control of xenon oscillations takes place inherently due to the mutual coupling between the local power production and the fuel temperature. (orig.).

2104 Power Reactors, Nonbreeding, Otherwise Moderated Or Unmoderated

Refer also to citation(s) 592, 609, 1496

494 (AECL–10000) **Steam generator tube performance: Experience with water-cooled nuclear power reactors during 1986.** Tatone, O.S. (Atomic Energy of Canada Ltd., Chalk River, ON (Canada). Chalk River Nuclear Labs.); Tapping, R.L.; Stipan, L. Atomic Energy of Canada Ltd., Chalk River, ON (Canada). Chalk River Nuclear Labs. Mar 1992. 87p. Order Number DE93603875. Source: OSTI; NTIS (US Sales Only); INIS.

A survey of steam generator operating experience for 1986 has been carried out for 184 pressurized water and pressurized heavy-water reactors, and 1 water-cooled, graphite-moderated reactor. Tubes were plugged at 75 of the reactors (40.5%). In 1986, 3737 tubes were plugged (0.14% of those in service) and 3148 tubes were repaired by sleeving. A small number of reactors accounted for the bulk of the plugged tubes, a phenomenon consistent with previous years. For 1986, the available tubesheet sludge data for 38 reactors has been compiled into tabular form, and sludge/deposit data will be incorporated into all future surveys.

495 (AECL–10388) **Ontario Hydro experience with extended-burnup power reactor fuel.** Novak, J. (Ontario Hydro, Toronto, ON (Canada)); Hastings, I.J. Atomic Energy of Canada Ltd., Chalk River, ON (Canada). Chalk River Nuclear Labs. Jul 1991. 17p. (CONF-910454–: International ANS/ENS topical meeting on LWR fuel performance: fuel for the 90s, Avignon (France), 21-24 Apr 1991). Order Number DE93603876. Source: OSTI; NTIS (US Sales Only); INIS.

UO_2 fuel has been irradiated in Ontario Hydro commercial reactors to a maximum burnup of 770 MW.h/kg U (30 000 MW.d/TeU) at a maximum linear power of 58 kW/m. There appears to be a burnup threshold at about 450 MW.h/kg U (20 000 MW.d/TeU), above which enhanced fission-gas release (up to 28%), grain growth and diametral strain (up to 2%) may be observed, with defects due to stress-corrosion cracking. The inference is that the extended-burnup effects are associated with a degradation in fuel conductivity and/or fuel-to-sheath heat transfer, resulting in acceleration of thermally activated processes. An interim burnup guideline of 450 MW.h/kg U (bundle average) has been defined for Ontario Hydro station operation. (11 refs., 5 figs.).

496 (AECL–10426) **An elasto-plastic model for mechanical contact between the pellets and sheath in CANDU nuclear fuel elements.** Arimescu, V.I. Atomic Energy of Canada Ltd., Chalk River, ON (Canada). Chalk River Nuclear Labs. Jun 1991. 15p. (CONF-9106378–: 12. annual conference of the Canadian Nuclear Society, Saskatoon (Canada), 9-12 Jun 1991). Order Number DE93603877. Source: OSTI; NTIS (US Sales Only); INIS.

During high-temperature transients, increased mechanical contact can occur between the fuel stack and the sheath in the axial and/or radial direction. As well, there is an axial linear power gradient and an axial gradient in mechanical properties of the sheath specific to a CANDU-type fuel element. This requires a code with the capability to treat multiple axial segments. This paper describes a contact model that allows the elasto-plastic mechanical contact in radial/axial direction for multiple axial segments. (14 figs., 5 refs.).

497 (AECL–10622) **Modeling CANDU type fuel behaviour during extended burnup irradiations using a revised version of the ELESIM code.** Arimescu, V.I.; Richmond, W.R. Atomic Energy of Canada Ltd., Chalk River, ON (Canada). Chalk River Nuclear Labs.; Ontario Hydro, Toronto, ON (Canada). May 1992. 27p. (COG–92-141.). Order Number DE93603878. Source: OSTI; NTIS (US Sales Only); INIS.

The high-burnup database for CANDU fuel, with a variety of cases, offers a good opportunity to check models of fuel behaviour, and to identify areas for improvement. Good agreement of calculated values of fission-gas release, and sheath hoop strain, with experimental data indicates that the global behaviour of the fuel element is adequately simulated by a computer code. Using, the ELESIM computer code, the fission-gas release, swelling, and fuel pellet expansion models were analysed, and changes made for gaseous swelling, and diffusional release of fission-gas atoms to the grain boundaries. Using this revised version of ELESIM, satisfactory agreement between measured values of fission-gas release was found for most of the high-burnup database cases. It is concluded that the revised version of the ELESIM code is able to simulate with reasonable accuracy high-burnup as well as low-burnup CANDU fuel.

498 (AECL–10636) **Fission-gas release in fuel performing to extended burnups in Ontario Hydro nuclear generating stations.** Floyd, M.R.; Novak, J.; Truant, P.T. Atomic Energy of Canada Ltd., Chalk River, ON (Canada). Chalk River Nuclear Labs. Jun 1992. 22p. Order Number DE93603879. Source: OSTI; NTIS (US Sales Only); INIS.

The average discharge burnup of CANDU fuel is about 200 MWh/kgU. A significant number of 37-element bundles have achieved burnups in excess of 400 MWh/kgU. Some of these bundles have experienced failures related to their extended operation. To date, hot-cell examinations have been performed on fuel elements from nine 37-element bundles irradiated in Bruce NGS-A that have burnups in the range of 300-800 MWh/kgU.[1] Most of these have declining power histories from peak powers of up to 59 kW/m. Fission-gas releases of up to 26% have been observed and

exhibit a strong dependence on fuel power. This obscures any dependence on burnup. The extent of fission-gas release at extended burnups was not predicted by low-burnup code extrapolations. This is attributed primarily to a reduction in fuel thermal conductivity which results in elevated operating temperatures. Reduced conductivity is due, at least in part, to the buildup of fission products in the fuel matrix. Some evidence of hyperstoichiometry exists, although this needs to be further investigated along with any possible relation to CANLUB graphite coating behaviour and sheath oxidation. Residual tensile sheath strains of up to 2% have been observed and can be correlated with fuel power/fission-gas release. SCC[2]-related defects have been observed in the sheath and endcaps of elements from bundles experiencing declining power histories to burnups in excess of 500 MWh/kgU. This indicates that the current recommended burnup limit of 450 MWh/kgU is justified. SCC-related defects have also been observed in ramped bundles having burnups < 450 MWh/kgU. Hence, additional guidelines are in place for power ramping extended-burnup fuel.

499 (AECL–10655) **Extended-burnup CANDU fuel: Description of database and comparisons with code predictions.** Richmond, W.R.; Bunge, J.M.; Arimescu, V.I. Atomic Energy of Canada Ltd., Chalk River, ON (Canada). Chalk River Nuclear Labs.; Ontario Hydro, Toronto, ON (Canada). Jun 1992. 20p. (COG–92-177.). Order Number DE93603880. Source: OSTI; NTIS (US Sales Only); INIS.

Interest in the modelling of extended-burnup CANDU fuel has been prompted by the examinations of such fuel from CANDU reactors and the development of extended-burnup CANDU fuel for the future. A study was done at AECL Research to compile a database on experimental irradiations whose outer-element burnups exceed 300 MW.h/kgU. This paper describes the elements that comprise the database and discusses analysis of fission-gas-release measurements against experimental parameters. Fission-gas-release measurements are also compared against predicted results from the MOD10 and MOD11 versions of the code ELESIM.

500 (BARC–1991/E/020) **Stress-induced reorientation of hydride precipitates in Zr-2.5Nb-0.5Cu garter springs under complex loading.** De, P.K. (Bhabha Atomic Research Centre, Bombay (India). Metallurgy Div.); John, J.T.; Raman, V.V.; Banerjee, S. Bhabha Atomic Research Centre, Bombay (India). 1991. 37p. Order Number DE93605811. Source: OSTI; NTIS (US Sales Only); INIS.

Zr-2.5Nb-0.5Cu garter springs which are placed between coolant and calandria tubes in PHWRs experience complex loading due to simultaneous application of tension, compression and torus bending moment due to coolant tubes. The gradual pick up of hydrogen by the garter springs during service is likely to have hydride platelets reoriented under the applied stresses. In the present paper, the magnitudes and the directions of the principal stresses under the complex loading condition obtained have been calculated and the extent of hydride reorientation predicted. Simulation experiments consisting of simulated loading of hydrogen (upto 400 ppm) precharged springs at the service temperature (300degC) and also in-situ hydrogen charging of the springs under simulated loading conditions have been carried out. In addition, hydrogen precharged springs have been subjected to temperature cycling between 50 and 300degC under complex loading conditions, to evaluate the influence of temperature variation on hydride reorientation. Metallographic examination of the hydride platelets in the above springs has shown an excellent agreement with the analytical prediction. Torus bending moment values appear to play a significant role in reorienting the hydride platelets. It has been observed that under normal torus bending moment corresponding to 90 mm dia coolant tubes hydrogen platelets close to the outer rim of the spiral get reoriented in the radial direction. However, on application a torus bending moment corresponding to 30 mm dia tubes, hydride platelets get reoriented along the radial direction, irrespective of the magnitude of tensile and compression loading. (author). 9 refs., 15 figs., 1 appendix.

501 (DOE/ER/13045–T1) **Hydrodynamically induced dryout and post dryout important to heavy water reactors: A yearly progress report.** Ishii, M.; Revankar, S.T.; Babelli, I.; Lele, S. Purdue Univ., Lafayette, IN (United States). Thermalhydraulics and Reactor Safety Lab. Jun 1992. 56p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-90ER13045. (PU-NE–92/2). Order Number DE93000403. Source: OSTI; NTIS; INIS; GPO Dep.

Recently, the safety of low pressure liquid cooled nuclear reactors has become a very important issue with reference to the operation of the heavy water reactors at Savannah River Plant. Under accident conditions such as loss-of-flow or loss-of-coolant, these reactors typically encounter unstable two-phase flow which may lead to the occurrence of dryout and subsequent fuel failure. An analytical study using the one-dimensional drift flux model was carried out to investigate the two-phase flow instability for Westinghouse Savannah River Site reactor. The analysis indicates that the first and higher order instabilities exist in the possible transient operational conditions. The instabilities are encountered at higher heat fluxes or lower flow rates. The subcooling has a stabilizing effect except at very low subcooling. An experimental loop has been designed and constructed to study the CBF induced by various flow instabilities. Details of this test loop are presented. Initial test results have been presented. The two-phase flow regimes and hydrodynamic behaviors in the post dryout region have been studied under propagating rewetting conditions. The effect of subcooling and inlet velocity on flow transition as well as on the quench front propagation was investigated. The test liquid was Freon 113 which was introduced into the bottom of the quartz test section whose walls were maintained well above the film boiling temperature of the test liquid, via a transparent heat transfer fluid. The flow regimes observed down stream of the upward moving quench front were the rough wavy, the agitated, and the dispersed droplet/ligaments. A correlation for the flow regime transition between the inverted annular and the dispersed droplet/ligament flow patterns was developed. The correlation showed a marked dependence on the void fraction at the CBF location and hence on the flow regime encountered in the pre-CBF region.

502 (DPW–871) **Reactor atmosphere.** Cherney, B.J. Du Pont de Nemours (E.I.) and Co., Aiken, SC (United States). 3 Apr 1951. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035 ;AC09-76SR00001. Order Number DE92040836. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This memorandum presents a conceptual design for a blanket gas system for a heavy water pile whose primary purpose is to collect gas resulting from moderator decomposition and to convert the deuterium portion of this gas to heavy water. Another function of the system is to remove holdup light or heavy water prior to operation or maintenance.

503 (EUR–14039, pp. 184-195) **Calculation of the pressure transient due to hydrogen deflagration in closed and vented volumes.** Klazek, P.S. (Ontario Hydro, Toronto, ON (Canada)). Commission of the European Communities, Luxembourg (Luxembourg). 1992. (CONF-9103264–: Proceedings of a Workshop on Hydrogen behaviour and mitigation in water-cooled nuclear power reactors, Brussels (Belgium), 4-8 Mar 1991). In *Hydrogen behaviour and mitigation in water-cooled nuclear power reactors.* 370p. Order Number DE93721166. Source: OSTI; NTIS (US Sales Only); INIS.

Reactor licensing assessments for multi-unit CANDU containments involve the calculation of the pressure transients due to postulated hydrogen deflagration. The calculation is based on an one dimensional consideration of the global mass and energy balance and relies on an empirical burn rate constant to adjust the mixture burning rate for momentum transfer effects. The work presented here shows the values of the empirical burn rate constant recommended for similar kinds of calculations involving vented hydrocarbon-air deflagrations are applicable to calculations for hydrogen-air deflagrations.

504 (EUR–14039, pp. 215-223) **A simplified analysis of the effect of hydrogen generation following a beyond design basis accident in an Indian PHWR.** Venkat Raj, V. (Bhabha Atomic Research Centre, Bombay (India)); Markandeya, S.G.; Ganju, S.; Ghosh, A.K.; Kakodkar, A. Commission of the European Communities, Luxembourg (Luxembourg). 1992. (CONF-9103264–: Proceedings of a Workshop on Hydrogen behaviour and mitigation in water-cooled nuclear power reactors, Brussels (Belgium), 4-8

Mar 1991). In *Hydrogen behaviour and mitigation in water-cooled nuclear power reactors.* 370p. Order Number DE93721166. Source: OSTI; NTIS (US Sales Only); INIS.

This paper presents the analysis carried out for the assessment of the effect of hydrogen generation following a Beyond Design Basis Accident in a standardised 235 MWe Indian Pressurised Heavy Water Reactor. The accident considered involves LOCA followed by the failure of the Emergency Core Cooling System and delay in reactor shut down. The break size considered for LOCA is 20% as this is likely to result in maximum core heat up. The effect of metal-water reaction, hydrogen generation and possible deflagration have been assessed.

505 (EUR–14363, pp. 49-79) **Report on the first steps of the remote-controlled dismantling of the pressure-tube HWGCR of KKN at Niederaichbach.** Ruedinger, V. (Kernforschungszentrum Karlsruhe GmbH (Germany)); Engelhardt, G.; Herzog, G.; Obst, H.J. Commission of the European Communities, Luxembourg (Luxembourg). 1992. (CONF-9109441–: 2. Seminar on practical decommissioning experience with nuclear installations in the European Community, Sellafield (United Kingdom), 25-26 Sep 1991). In *Practical decommissioning experience with nuclear installations in the European Community.* 207p. Order Number DE93721081. Source: OSTI; NTIS (US Sales Only); INIS.

Dismantling operations at the prototype NPP Niederaichbach (KKN) started in 1988. After removal of all inactive as well as the contaminated components the remote-controlled dismountment of the activated pressure tube reactor could be started in November 1990. These operations are performed inside an additional containment in the reactor building with the aid of especially designed equipment. So far 50% of this phase of decommissioning was performed successfully. Due to the precautions taken the radiation exposure of personnel as well as emissions to the environment could be kept at very low levels.

506 (INFO–0234-1) **Follow-up to the accident at Chernobyl and its implications for the safety of CANDU reactors.** Atomic Energy Control Board, Ottawa, ON (Canada). May 1990. 45p. (In English, French). Order Number DE93603881. Source: OSTI; NTIS (US Sales Only); INIS.

This report updates the status of the nine recommendations arising from the AECB staff review of the Chernobyl accident (INFO–0234). Six of the nine recommendations have been satisfactorily responded to by the Canadian nuclear utilities and are considered to be closed. Any follow-up actions arising from the responses to the recommendations will be addressed as part of the continuing licensing process. Of the remaining three, one concerns the effectiveness of the reactor shutdown systems under unusual circumstances. Satisfactory progress is being made. The other two outstanding items concern reviews of emergency and fire fighting practices. Again, satisfactory progress is being made but the response to the recommendations is not yet complete. Each recommendation is discussed separately in the body of this report.

507 (INFO–0317) **The commissioning of nuclear power plants.** Atomic Energy Control Board, Ottawa, ON (Canada). Advisory Committee on Nuclear Safety. Sep 1989. 27p. (In English, French). (ACNS–13;CCSN–13.). Order Number DE93603882. Source: OSTI; NTIS (US Sales Only); INIS.

The objectives and requirements to be met in commissioning nuclear power plants are presented. The objective of commissioning is to ensure that each component, subsystem, system, or structure in a plant will be capable of fulfilling its design requirements throughout its design life. The requirements for commissioning are: the preparation of a detailed, comprehensive, documented program to demonstrate that all components, systems and structures relevant to safety meet design intent; documented evidence that safety systems are fully operable and can meet design requirements; and, appropriate documentation of the actual state or behaviour of all components, systems and structures relevant to safety. All systems must be included in the commissioning program. Whenever possible, full safety system test should be performed. If a full system in situ test is not possible, alternative means are suggested. (8 refs.).

508 (INFO–0319) **Canadian programs on understanding and managing aging degradation of nuclear power plant components.** Chadha, J.A. (Ontario Hydro, Toronto, ON (Canada)); Pachner, J. Atomic Energy Control Board, Ottawa, ON (Canada). Jun 1989. 14p. (CONF-890696–: 10. annual conference of the Canadian Nuclear Association: nuclear fission–halfway to the first century, Ottawa (Canada), 4-7 Jun 1989). Order Number DE93603883. Source: OSTI; NTIS (US Sales Only); INIS.

Maintaining adequate safety and reliability of nuclear power plants and nuclear power plant life assurance and life extension are growing in importance as nuclear plants get older. Age-related degradation of plant components is complex and not fully understood. This paper provides an overview of the Canadian approach and the main activities and their results towards understanding and managing age-related degradation of nuclear power plant components, structures and systems. A number of pro-active programs have been initiated to anticipate, detect and mitigate potential aging degradation at an early stage before any serious impact on plant safety and reliability. These programs include Operational Safety Management Program, Nuclear Plant Life Assurance Program, systematic plant condition assessment, refurbishment and upgrading, post-service examination and testing, equipment qualification, research and development, and participation in the IAEA programs on safety aspects of nuclear power plant aging and life extension. A regulatory policy on nuclear power plants is under development and will be based on the domestic as well as foreign and international studies and experience.

509 (INFO–0365) **AECB staff annual report on Point Lepreau G.S. for the year 1989.** Atomic Energy Control Board, Ottawa, ON (Canada). May 1990. 17p. Order Number DE93603884. Source: OSTI; NTIS (US Sales Only); INIS.

This report is a review by Atomic Energy Control Board (AECB) staff of the operation of Point Lepreau Nuclear Generating Station during 1989. The review is based on information contained in the various documents submitted by New Brunswick Power under the terms of the Operating Licence and on information gathered by AECB staff during routine site monitoring, inspections and audits. AECB staff considers that the station has been operated and managed safely during 1989. The lifetime availability performance of the four special safety systems is poor, and the initiatives NB Power is proposing to improve this performance will need to be pursued aggressively to ensure that these systems meet their availability requirements in the future. Slow response to AECB action items and excessive delays in the production of full reports for events reportable under the operating licence indicate a need for NB Power to examine the organization and resourcing of some of its safety and compliance functions. (tab.).

510 (INFO–0367) **AECB staff review of Bruce NGS 'A' operation for the year 1989.** Atomic Energy Control Board, Ottawa, ON (Canada). Jun 1990. 31p. Order Number DE93603885. Source: OSTI; NTIS (US Sales Only); INIS.

The operation of the Bruce Nuclear Generating Station 'B' is monitored and licensing requirements are enforced by the Atomic Energy Control Board (AECB). This report records the conclusions of the AECB staff assessment of Bruce NGS 'A' during 1989 and the early part of 1990. Overall operation of the station met acceptable safety standards. Despite numerous problems and technical difficulties encountered, station management and supervisory personnel acted with due caution and made decisions in the interests of safety. There was evidence of improvement in a number of key areas, supported by pertinent indicators in the objective measures table. The extensive inspection and maintenance programs carried out during the year revealed the extent of component deterioration due to aging to be larger than expected. Hydrogen embrittlement of pressure tubes, erosion/corrosion of steam and feed water valves, heat exchanger tubes and piping, fouling of boilers and heat exchangers, and environmental damage of electrical equipment are examples. Continued aging of plant equipment and its potential for reducing the margins for safe operation must be taken into account by Ontario Hydro in establishing priorities and target dates for completion of actions to resolve identified problems at Bruce NGS 'A'. (2 tabs.).

511 (INFO–0368) **AECB staff review of Bruce NGS 'B' operation for the year 1989.** Atomic Energy Control Board, Ottawa, ON (Canada). Jun 1990. 22p. Order Number DE93603886. Source: OSTI; NTIS (US Sales Only); INIS.

The operation of the Bruce Nuclear Generating Station 'B' is monitored and licensing requirements are enforced by the Atomic Energy Control Board (AECB), which observes operation of the reactors, conducts audits, witnesses important activities, reviews station documentation and reports, and issue approvals, where appropriate, in accordance with licence conditions. This report records the conclusions of the AECB staff assessment of Bruce NGS 'B' during 1989. In general, the station operated within acceptable safety standards. Quality improvement initiatives started in 1989 should lead to improved station maintenance and operation in coming years. Ontario Hydro still needs to improve the administration of operating memos, deficiency reports and call-ups. Station management must ensure that shift supervisors and reactor first operators operate the station in a conservative manner at all times and put safety interests first when responding to a unit upset. (2 tabs.).

512 (INFO–0370) **Fuel channel refilling: Data analysis.** Shoukri, M. (BSC Thermal Science Inc., Oakville, ON (Canada)); Abdul-Razzak, A. Atomic Energy Control Board, Ottawa, ON (Canada). Apr 1990. 131p. Project 2.177.1. Order Number DE93603887. Source: OSTI; NTIS (US Sales Only); INIS.

Analysis of existing data on fuel channel refilling is presented. The analysis focuses on the data obtained using the Stern Laboratories Cold Water Injection Test (CWIT) Facility. The two-fluid model thermal-hydraulics computer code CATHENA is also used to simulate experimental results on fuel channel refilling from both the CWIT and RD-14 facilities. Conclusions related to single and double break tests, including the effect of non-condensible gases, are presented. A set of recommendations is given for further analysis and separate effect experiments. (67 figs., 5 tabs., 24 refs.).

513 (INFO–0404) **Recommendations relating to safety-critical real-time software in nuclear power plants.** Atomic Energy Control Board, Ottawa, ON (Canada). Advisory Committee on Nuclear Safety. Jan 1992. 22p. (In English, French). (ACNS–19;CCSN–19.). Order Number DE93603888. Source: OSTI; NTIS (US Sales Only); INIS.

The Advisory Committee on Nuclear Safety (ACNS) has reviewed safety issues associated with the software for the digital computers in the safety shutdown systems for the Darlington NGS. From this review the ACNS has developed four recommendations for safety-critical real-time software in nuclear power plants. These recommendations cover: the completion of the present efforts to develop an overall standard and sub-tier standards for safety-critical real-time software; the preparation of schedules and lists of responsibilities for this development; the concentration of AECB efforts on ensuring the scrutability of safety-critical real-time software; and, the collection of data on reliability and causes of failure (error) of safety-critical real-time software systems and on the probability and causes of common-mode failures (errors). (9 refs.).

514 (KAERI/RR–1002/90) **Development of nuclear fuel. Development of CANDU advanced fuel bundle.** Suk, Ho Chun (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Hwang, Woan; Jeong, Young Hwan; Jung, Sung Hoon. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Jul 1991. 399p. (In Korean). Order Number DE93605812. Source: OSTI; NTIS (US Sales Only); INIS.

In order to develop CANDU advanced fuel, the agreement of the joint research between KAERI and AECL was made on February 19, 1991. AECL conceptual design of CANFLEX bundle for Bruce reactors was analyzed and then the reference design and design drawing of the advanced fuel bundle with natural uranium fuel for CANDU-6 reactor were completed. The CANFLEX fuel cladding was preliminarily investigated. The fabricability of the advanced fuel bundle was investigated. The design and purchase of the machinery tools for the bundle fabrication for hydraulic scoping tests were performed. As a result of CANFLEX tube examination, the tubes were found to be meet the criteria proposed in the technical specification. The dummy bundles for hydraulic scoping tests have been fabricated by using the process and tools, where the process parameters and tools have been newly established. (Author).

515 (KAERI/RR–1028/91) **Development of CANFLEX fuel bundle.** Suk, Ho Chun (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Hwang, Woan; Jeong, Young Hwan. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Dec 1991. 516p. (In Korean). Order Number DE93605813. Source: OSTI; NTIS (US Sales Only); INIS.

This research project is underway in cooperation with AECL to develop the CANDU advanced fuel bundle(so-called CANFLEX) which can enhance reactor safety and fuel economy in comparison with the current CANDU fuel and which can be used with natural uranium, slightly enriched uranium and other advanced fuel cycle. As the final schedule, the advanced fuel will be verified by carrying out a large scale demonstration of the bundle irradiation in a commercial CANDU reactors for 1996 and 1997, and consequently will be used in the existing and future reactors in Korea. The research activities during this year include the basic design of CANFLEX fuel with slightly enriched uranium(CANFLEX-SEU), with emphasis on the extension of fuel operation limit. Based on this basic design, CANFLEX fuel was mocked up. Out-of-pile hydraulic scoping tests were conducted with the fuel. (Author).

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Refer also to citation(s) 549, 606, 608, 615, 705, 2440, 2441

516 (ANL/CP–72040) **Irradiation experience with HT9-clad metallic fuel.** Pahl, R.G.; Lahm, C.E.; Tsai, H.; Billone, M.C. Argonne National Lab., IL (United States). [1991]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-911001–26: International conference on fast reactor systems and fuel cycles, Kyoto (Japan), 27 Oct - 1 nov 1991). Order Number DE92041093. Source: OSTI; NTIS; INIS; GPO Dep.

the safe and reliable performance of metallic fuel is currently under study and demonstration in the Integral Fast Reactor program. In-reactor tests of HT9-clad metallic fuel have now reached maturity and have all shown good performance characteristics to burnups exceeding 17.5 at. % in the lead assembly. Because this low-swelling tempered martensitic alloy is the cladding of choice for high fluence applications, the experimental observations and performance modelling efforts reported in this paper play an important role in demonstrating reliability.

517 (ANL/CP–76685) **Physics considerations in the design of liquid metal reactors for transuranium element consumption.** Khalil, H.; Hill, R.; Fujita, E.; Wade, D. Argonne National Lab., IL (United States). [1992]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9209224–1: Specialists' meeting on use of fast breeder reactors for actinide transmutation, Obninsk (Russian Federation), 22-24 Sep 1992). Order Number DE92041131. Source: OSTI; NTIS; INIS; GPO Dep.

The management of transuranic nuclides in liquid metal reactors (LMR's) is considered based on the use of the Integral Fast Reactor (IFR) concept. Unique features of the IFR fuel cycle with respect to transuranic management are identified. These features are exploited together with the hard spectrum of LMR's to demonstrate the neutronic feasibility of a wide range of transuranic management options ranging from efficient breeding to pure consumption. Core physics aspects of the development of a low sodium void worth transuranic burner concept are described. Neutronics performance parameters and reactivity feedback characteristics estimated for this core concept are presented.

518 (ANTO–00075) **ALMR market assessment: The US Advanced Liquid Metal Reactor Program.** MacGregor, P.R.; Yates, R.L. General Electric Co., San Jose, CA (United States). Sep 1992. 81p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-89SF17445. Order Number DE93000353. Source: OSTI; NTIS; INIS; GPO Dep.

This report examines the potential market size for electrical generating capacity requirements from the year 2010 through the year 2030 in the United States. In particular, the report explores the ability of the Advanced Liquid Metal Reactor (ALMR) to be a viable generating capacity option in terms of competing economics during

that period. In this study, the impact of cost sensitivities, including ALMR capital costs and fossil fuel prices, on the economic potential of the ALMR are analyzed as well.

519 (EUR–14023) **Sodium fire aerosol behaviour: a review of studies carried out under the auspices of the CEC.** Dunbar, I.H. (UKAEA Risley Nuclear Power Development Establishment, Culcheth (United Kingdom). Safety and Reliability Directorate). Commission of the European Communities, Luxembourg (Luxembourg). 1992. 39p. Contract ETNU-0006-UK(A). Source: OSTI; NTIS (US Sales Only); INIS.

The purpose of the present report was to produce a synthesis of the results of four studies (Reports EUR 9172 EN, EUR 9203 EN, SESRU No. EF.21.12.R/88.527 and EUR 13274 EN) bringing out their overall contribution to our understanding of the way sodium fire aerosols behave in secondary containment buildings. In particular the following questions are addressed in the light of the information produced by the CONT group studies: (i) Are current instrumentation techniques capable of obtaining the data about aerosols needed to validate the computer models. (ii) Is the current database produced by sodium fire experiments sufficient to validate the computer models. (iii) Can the current computer codes predict the behaviour of sodium fire aerosols in hypothetical LMFBR accidents with sufficient accuracy.

520 (FRCEA-TH–366) **Damage of the Phenix fuel element clads. Realization and analysis of ultimate loading experiences. Validation and optimization of the RAMSESII methodology.** Schmidt, N. Conservatoire National des Arts et Metiers (CNAM), 75 - Paris (France); CEA Centre d'Etudes de Cadarache, 13 - Saint-Paul-lez-Durance (France). Dept. d'Etudes des Combustibles. May 1992. 174p. (In French). Order Number DE93721225. Source: OSTI; NTIS (US Sales Only); INIS.

The work executed in this memory has for objective the evaluation, from test results, of the real margins coming from the RAMSESII methodology (RAMSES: Mechanical Analysis Regulations for Structures).

521 (IGC–127) **Activity report of Reactor Physics Division - 1991.** Indira, R. (ed.). Indira Gandhi Centre for Atomic Research, Kalpakkam (India). 1992. 124p. Order Number DE93605824. Source: OSTI; NTIS (US Sales Only); INIS.

The reseach and development (R and D) activities of the Reactor Physics Division of Indira Gandhi Centre for Atomic Research (IGCAR), Kalpakkam during 1991 are reported. The activites are arranged under the headings : Nuclear Data Proceeding and Validation, Core Physics and Operation studies, Reactor Kinetics and Safety analysis, Reactor Noise Analysis and Radiation Transport and Shielding studies. List of publications is given at the end. (author). figs., tabs., r efs.

522 (INIS-BR–2942, pp. 12) **Assembly of a thermohydraulic-neutronic simulator-optimizer for the design of low power experimental fast reactor.** Waintraub, M. (Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Div. de Fisica de Reatores); Jachic, J. Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1989. 147p. (In Portuguese). (CONF-861272–: 6. national meeting of reactor physics and thermohydraulic, Sao Jose dos Campos (Brazil), 3-5 Dec 1986). In *Triennial technical report - 1986, 1987, 1988 - Instituto de Engenharia Nuclear (IEN) -Dept. of Reactors (DERE).* Order Number DE93605069. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. FAST REACTORS/simulators; ANALYTICAL SOLUTION; BUCKLING; C CODES; CALIBRATION; SIMULATORS; OPTIMIZATION; SPECIFICATIONS; THERMODYNAMICS

523 (INIS-BR–2942, pp. 25) **Calculation of minimum mass of plutonium required for experimental fast reactor construction.** Waintraub, M. (Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Div. de Fisica de Reatores). Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1989. 147p. (In Portuguese). In *Triennial technical report - 1986, 1987, 1988 - Instituto de Engenharia Nuclear (IEN) -Dept. of Reactors (DERE).* Order Number DE93605069. Source: OSTI; NTIS (US Sales Only); INIS.

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Published in summary form only. FAST REACTORS/plutonium; CONTROL ELEMENTS; CROSS SECTIONS; ENRICHED URANIUM; PLUTONIUM; PLANNING; REACTIVITY

524 (INIS-BR–2942, pp. 57-58) **Study on flow in wire wrap spaced hexagonal rod bundles.** Bloch, M. (Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores); Morgado, A. Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1989. 147p. (In Portuguese). In *Triennial technical report - 1986, 1987, 1988 - Instituto de Engenharia Nuclear (IEN) -Dept. of Reactors (DERE).* Order Number DE93605069. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. LMFBR TYPE REACTORS/fluid flow; LMFBR TYPE REACTORS/fuel wires; COMPUTER CALCULATIONS; FRICTION FACTOR; HEXAGONAL CONFIGURATION; RESISTORS; WIRES

525 (INIS-BR–2942, pp. 91) **On the job training on fast reactors components design.** Bezerra, L.M. (Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores); Jesus Miranda, C.A. de. Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1989. 147p. (In Portuguese). In *Triennial technical report - 1986, 1987, 1988 - Instituto de Engenharia Nuclear (IEN) -Dept. of Reactors (DERE).* Order Number DE93605069. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. FAST REACTORS/bilateral agreements; FAST REACTORS/education; BRAZILIAN CNEN; EDUCATION; ITALIAN ENEA; SPECIFICATIONS

526 (INIS-BR–2942, pp. 127-128) **Modeling of the primary system of a pool type fast reactor.** Sato, E.F. (Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Div. de Termohidraulica de Reatores); Moreira, M.L. Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1989. 147p. (CONF-881009–: LIMET'88: 4th international conference on liquid metal engineering and technology, Avignon (France), 17-21 Oct 1988). In *Triennial technical report - 1986, 1987, 1988 - Instituto de Engenharia Nuclear (IEN) -Dept. of Reactors (DERE).* Order Number DE93605069. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. EBR-2 REACTOR/computerized simulation; EBR-2 REACTOR/primary coolant circuits; HYDRAULICS; S CODES; THERMODYNAMICS; TRANSIENTS

527 (INIS-BR–2942, pp. 131) **Vacuum distiller for determining the presence of oxygen in sodium.** Souza, M.C.L. (Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Div. de Metais Liquidos); Goncalves, A.C.; Brito Aghina, L.O. de; Torres, A.R.; Castro, P.M. Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1989. 147p. (In Portuguese). (CONF-860343–: 1. general congress on nuclear energy, Rio de Janeiro (Brazil), 17-20 Mar 1986). In *Triennial technical report - 1986, 1987, 1988 - Instituto de Engenharia Nuclear (IEN) -Dept. of Reactors (DERE).* Order Number DE93605069. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. DISTILLATION EQUIPMENT/oxygen meters; DISTILLATION EQUIPMENT/sodium; FAST REACTORS/distillation equipment; COOLANT LOOPS; SODIUM; TEMPERATURE DEPENDENCE; VACUUM SYSTEMS

528 (INIS-BR–2942, pp. 132) **Characteristics and composition of smokes in sodium fires.** Goncalves, A.C. (Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Div. de Metais Liquidos); Torres, A.R.; Brito Aghina, L.O. de; Castro, P.M. Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1989. 147p. (In Portuguese). (CONF-860343–: 1. general congress on nuclear energy, Rio de Janeiro (Brazil), 17-20 Mar 1986). In *Triennial technical report - 1986, 1987, 1988 - Instituto de Engenharia Nuclear (IEN) -Dept. of Reactors (DERE).* Order Number DE93605069. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. FAST REACTORS/fires; FIRES/smokes; FIRES; SMOKES; QUANTITY RATIO; SAFETY; SIMULATION; SODIUM COMPOUNDS; TEMPERATURE DEPENDENCE

529 (INIS-BR–2942, pp. 138-139) **Hypothetical sodium accident analysis in the CTS-1 cooled thermal loop during the heat exchanger obstruction removal operation.** Torres, A.R. (Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Div. de Metais Liquidos); Correa, S.M.; Goncalves, A.C. Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1989. 147p. (In Portuguese). In *Triennial technical report - 1986, 1987, 1988 - Instituto de Engenharia Nuclear (IEN) -Dept. of Reactors (DERE).* Order Number DE93605069. Source: OSTI; NTIS (US Sales Only); INIS.

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Published in summary form only. PIPELINES/accidents; PIPELINES/sodium; COOLANT LOOPS; F CODES; FAST REACTORS; HEAT EXCHANGERS; LEAKS; PIPELINES; ACCIDENTS; SODIUM; RESTRAINTS; RUPTURES

530 (INIS-BR–2942, pp. 109) **First experimental tests with the assembly for studies on seven rod bundles flow with fast reactors geometry.** Bloch, M. (Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Div. de Termohidraulica de Reatores); Morgado, A. Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1989. 147p. (In Portuguese). In *Triennial technical report - 1986, 1987, 1988 - Instituto de Engenharia Nuclear (IEN) -Dept. of Reactors (DERE).* Order Number DE93605069. Source: OSTI; NTIS (US Sales Only); INIS.

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Published in summary form only. LMFBR TYPE REACTORS/friction factor; ERRORS; FLUID FLOW; REYNOLDS NUMBER

531 (INIS-BR–2942, pp. 109-111) **Modelling of the primary coolant circuit of a EBR-II fast reactor. Part I: theory.** Sato, E.F. (Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Div. de Termohidraulica de Reatores); Moreira, M.L. Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1989. 147p. (In Portuguese). In *Triennial technical report - 1986, 1987, 1988 - Instituto de Engenharia Nuclear (IEN) -Dept. of Reactors (DERE).* Order Number DE93605069. Source: OSTI; NTIS (US Sales Only); INIS.

Published in full form as CT-DITRE 06/86.

Published in summary form only. EBR-2 REACTOR/primary coolant circuits; EBR-2 REACTOR/transients; TRANSIENTS; FLUID FLOW; HEAT TRANSFER; HYDRAULICS; PLANNING; PROGRAMMING; PUMPS; THERMODYNAMICS

532 (INIS-BR–2942, pp. 123) **Thermohydraulic preliminary design of a experimental fast reactor. Part I: medium fuel element.** Gadelha, J.A.M. (Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Div. de Termohidraulica de Reatores); Botelho, D.A. Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1989. 147p. (In Portuguese). In *Triennial technical report - 1986, 1987, 1988 - Instituto de Engenharia Nuclear (IEN) -Dept. of Reactors (DERE).* Order Number DE93605069. Source: OSTI; NTIS (US Sales Only); INIS.

Published in full form as CT-DITRE 10/87.

Published in summary form only. FAST REACTORS/thermodynamics; C CODES; COMPUTER CALCULATIONS; THERMODYNAMICS; FLOW RATE; FUEL ELEMENTS; HYDRAULICS; SODIUM

533 (INIS-BR–2942, pp. 124) **Friction factor in seven rods bundle in fast reactors typical geometry.** Bloch, M. (Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Div. de Termohidraulica de Reatores); Sampaio, P.A.B. de. Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1989. 147p. (In Portuguese). In *Triennial technical report - 1986, 1987, 1988 - Instituto de Engenharia Nuclear (IEN) -Dept. of Reactors (DERE).* Order Number DE93605069. Source: OSTI; NTIS (US Sales Only); INIS.

Published in full form as CT-DITRE 11/87.

Published in summary form only. COOLANT LOOPS/friction factor; FRICTION FACTOR/reynolds number; FAST REACTORS; FLUID FLOW; PRESSURE MEASUREMENT; WATER; WIRES

534 (INIS-BR–2942, pp. 126) **Development of the computer code for transients analysis in experimental fast reactor.** Moreira, M.L. (Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Div. de Termohidraulica de Reatores); Sato, E.F. Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1989. 147p. (In Portuguese). In *Triennial technical report - 1986, 1987, 1988 - Instituto de Engenharia Nuclear (IEN) -Dept. of Reactors (DERE).* Order Number DE93605069. Source: OSTI; NTIS (US Sales Only); INIS.

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Published in summary form only. EBR-2 REACTOR/computerized simulation; EBR-2 REACTOR/transients; TRANSIENTS; HYDRAULICS; PRIMARY COOLANT CIRCUITS; S CODES; SECONDARY COOLANT CIRCUITS; THERMODYNAMICS

2106 Power Reactors, Mobile, Propulsion, Package, and Transportable

535 (CONF-9208154–1) **System model development for nuclear thermal propulsion.** Hannan, N.A. (Argonne National Lab., IL (United States)); Worley, B.A.; Walton, J.T.; Perkins, K.R.; Buksa, J.J.; Dobranich, D. Oak Ridge National Lab., TN (United States). [1992]. 11p. Sponsored by USDOE, Washington, DC (United States); Department of Defense, Washington, DC (United States); National Aeronautics and Space Administration, Washington, DC (United States). DOE Contract AC05-84OR21400. From 43. Congress of the International Astronautical Federation; Washington, DC (United States); 28 Aug - 5 sep 1992. Order Number DE92041262. Source: OSTI; NTIS; GPO Dep.

A critical enabling technology in the evolutionary development of nuclear thermal propulsion (NTP) is the ability to predict the system performance under a variety of operating conditions. This is crucial for mission analysis and for control subsystem testing as well as for the modeling of various failure modes. Performance must be accurately predicted during steady-state and transient operation, including startup, shutdown and post operation cooling. The development and application of verified and validated system models has the potential to reduce the design, testing, cost and time required for the technology to reach flight-ready status. Since October 1991, the US Department of Energy (DOE), Department of Defense (DOD) and NASA have initiated critical technology development efforts for NTP systems to be used on Space Exploration Initiative (SEI) missions to the Moon and Mars. This paper presents the strategy and progress of an interagency NASA/DOE/DOD team for NTP system modeling.

536 (NUTEK-NYEL–92-2) **Thermionic energy converters.** Holmlid, L. (Chalmers Tekniska Hoegskola, Goeteborg (Sweden)); Svensson, R. Swedish National Board for Industrial and Technical Development (NUTEK), Stockholm (Sweden). May 1991. 8p. (In Swedish). Project NUTEK-411-233. Order Number DE93603792. Source: OSTI; NTIS; INIS.

Research and development work on thermionic energy converters (TEC) in the Russian Federation and USA is at present mainly adressed towards TEC equipped nuclear power reactors for use in space. During the last year a large scale cooperation has started, around a Topas-II reactor which has been purchased by USA for tests. A direct cooperation also exists between companies in the Netherlands and the Russian Federation aimed towards more efficient converters. We have during the last year continued our work on the use of excited states in converters, and we have performed experimental studies of the operation of the converter and of the composition and properties of the plasma. We reach very low work functions on the collector in the presence of excited states. This gives very good results concerning the so called barrier index (figure of merit for converters). The process of application for a patent for this new type of collector with low work function has been initiated. (au).

537 (PNL-SA–20523) **Advanced hybrid nuclear propulsion Mars mission performance enhancement.** Dagle, J.E.; Noffsinger, K.E.; Segna, D.R. Pacific Northwest Lab., Richland, WA (United States). Feb 1992. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-9208114–4: American Nuclear Society meeting, Jackson Hole, WY

(United States), 16-19 Aug 1992). Order Number DE93001309. Source: OSTI; NTIS; GPO Dep.

Nuclear electric propulsion (NEP), compared with chemical and nuclear thermal propulsion (NTP), can effectively deliver the same mass to Mars using much less propellant, consequently requiring less mass delivered to Earth orbit. The lower thrust of NEP requires a spiral trajectory near planetary bodies, which significantly increases the travel time. Although the total travel time is long, the portion of the flight time spent during interplanetary transfer is shorter, because the vehicle is thrusting for much longer periods of time. This has led to the supposition that NEP, although very attractive for cargo missions, is not suitable for piloted missions to Mars. However, with the application of a hybrid approach to propulsion, the benefits of NEP can be utilized while drastically reducing the overall travel time required. Development of a dual-mode system, which utilizes high-thrust NTP to propel the spacecraft from the planetary gravitational influence and low-thrust NEP to accelerate in interplanetary space, eliminates the spiral trajectory and results in a much faster transit time than could be obtained by either NEP or NTP alone. This results in a mission profile with a lower initial mass in low Earth orbit. In addition, the propulsion system would have the capability to provide electrical power for mission applications.

538 (SAND–92-1820C) **System model development for nuclear thermal propulsion.** Walton, J.T. (National Aeronautics and Space Administration, Cleveland, OH (United States). Lewis Research Center); Hannan, N.A.; Perkins, K.R.; Buksa, J.J.; Worley, B.A.; Dobranich, D. Sandia National Labs., Albuquerque, NM (United States). [1992]. 12p. Sponsored by USDOE, Washington, DC (United States); Department of Defense, Washington, DC (United States); National Aeronautics and Space Administration, Washington, DC (United States). DOE Contract AC04-76DP00789. (IAF–92-0568;CONF-920879–2: World space congress, Washington, DC (United States), 28 Aug - 5 sep 1992). Order Number DE93000754. Source: OSTI; NTIS; INIS; GPO Dep.

A critical enabling technology in the evolutionary development of nuclear thermal propulsion (NTP) is the ability to predict the system performance under a variety of operating conditions. Since October 1991, US (DOE), (DOD) and NASA have initiated critical technology development efforts for NTP systems to be used on Space Exploration Initiative (SEI) missions to the Moon and Mars. This paper presents the strategy and progress of an interagency NASA/DOE/DOD team for NTP system modeling. It is the intent of the interagency team to develop several levels of computer programs to simulate various NTP systems. An interagency team was formed for this task to use the best capabilities available and to assure appropriate peer review. The vision and strategy of the interagency team for developing NTP system models will be discussed in this paper. A review of the progress on the Level 1 interagency model is also presented.

539 (SAND–92-2049C) **Handling effluent from nuclear thermal propulsion system ground tests.** Shipers, L.R.; Allen, G.C. Sandia National Labs., Albuquerque, NM (United States). 9 Sep 1992. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-9209177–2: Nuclear power engineering in space nuclear rocket engines, Kazakhstan (Russian Federation), 22-26 Sep 1992). Order Number DE93000752. Source: OSTI; NTIS; INIS; GPO Dep.

A variety of approaches for handling effluent from nuclear thermal propulsion system ground tests in an environmentally acceptable manner are discussed. The functional requirements of effluent treatment are defined and concept options are presented within the framework of these requirements. System concepts differ primarily in the choice of fission-product retention and waste handling concepts. The concept options considered range from closed cycle (venting the exhaust to a closed volume or recirculating the hydrogen in a closed loop) to open cycle (real time processing and venting of the effluent). This paper reviews the different methods to handle effluent from nuclear thermal propulsion system ground tests.

2107 Regulation and Licensing

Refer also to citation(s) 724

540 (NUREG–1242-Vol.2-Pt.1) **NRC review of Electric Power Research Institute's Advanced Light Water Reactor Utility Requirements Document - Evolutionary plant designs, Chapter 1, Project No. 669: Volume 2, Part 1.** Nuclear Regulatory Commission, Washington, DC (United States). Associate Directorate for Advanced Reactors and License Renewal. Aug 1992. 516p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). Source: OSTI; NTIS; INIS; GPO.

The staff of the US Nuclear Regulatory Commission has prepared Volume 2 (Parts 1 and 2) of a safety evaluation report (SER), "NRC Review of Electric Power Research Institute's Advanced Light Water Reactor Utility Requirements Document – Evolutionary Plant Designs," to document the results of its review of the Electric Power Research Institute's "Advanced Light Water Reactor Utility Requirements Document." This SER gives the results of the staff's review of Volume II of the Requirements Document for evolutionary plant designs, which consists of 13 chapters and contains utility design requirements for an evolutionary nuclear power plant (approximately 1300 megawatts-electric).

2108 Economics

Refer also to citation(s) 232, 518, 565

541 (INFO–0318) **Review of 12-hour shifts at nuclear generating stations: Final report.** Smiley, A. (Human Factors Association of Canada, Toronto, ON (Canada)); Moray, N.P. Atomic Energy Control Board, Ottawa, ON (Canada). Apr 1989. 63p. Project 2.131.1. Order Number DE93604017. Source: OSTI; NTIS (US Sales Only); INIS.

This project reviewed the practice of 12-hour shift work schedules at nuclear power plants, and its relationship to safety. The current literature was examined for information on accidents, fatigue and personal preferences. Interviews with operators and maintainers showed that these groups had attitude and preference differences related to both 12 hour shift schedules and overtime work opportunities. Several factors related to 12-hour schedules were identified which could affect safety, but which have not been adequately considered. (24 refs.).

542 (INIS-BR–2942, pp. 75) **Energy equation steady solution for calculation of natural convection in sodium loops.** Walsh, L.M. (Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores). Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1989. 147p. (In Portuguese). In *Triennial technical report - 1986, 1987, 1988 - Instituto de Engenharia Nuclear (IEN) -Dept. of Reactors (DERE).* Order Number DE93605069. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. COOLANT LOOPS/natural convection; COOLANT LOOPS/sodium; COMPUTER CALCULATIONS; SODIUM; FINITE DIFFERENCE METHOD; TIME DEPENDENCE

543 (KAERI/RR–1057/91) **Economic analysis of nuclear power generation.** Lee, Young Gun (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Lee, Han Myung; Song, Ki Dong; Lee, Man Ki; Kim, Seung Su; Moon, Kee Hwan; Chung, Whan Sam; Kim, Kyung Pyo; Cho, Sang Goo. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Jan 1992. 156p. (In Korean). Order Number DE93605954. Source: OSTI; NTIS (US Sales Only); INIS.

The purpose of this study is to clarify the role of nuclear power generation under the circumstances of growing concerns about environmental impact and to help decision making in electricity sector. In this study, efforts are made to estimate electricity power generation cost of major power options by incorporating additional cost to reduce environmental impact and to suggest an optimal plant mix in this case. (Author).

2109 Process Heat Reactors

544 (AECL–9975) **Co-operation between Canada and Hungary on the application of the SLOWPOKE energy system to district heating in eastern Europe.** Kay, R.E.; Halzl, J.; Sigmond, G.; Takats, F.; Bakacs, I. Atomic Energy of Canada Ltd., Ottawa, ON (Canada). Jun 1989. 14p. (CONF-8908292–: Post-conference seminar on small and medium-sized nuclear reactors, San Diego, CA (United States), 21-23 Aug 1989). Order Number DE93603905. Source: OSTI; NTIS (US Sales Only); INIS.

The SLOWPOKE Energy System is a nuclear energy source designed to provide up to 10 MWt of heat energy in the form of hot water to medium- and large- size district heating systems. An appropriate grouping of Canadian and Hungarian companies with the support of the Hungarian Ministry of Industry is studying the technical, economic, commercial, and nuclear licensability aspects of the application of the SLOWPOKE Energy System to district heating in Hungary. Results of these studies indicate that there is a significant potential market for SLOWPOKE Energy Systems in existing district heating systems, that the SLOWPOKE Energy System can be readily integrated into such systems, that high capacity factors can be achieved, and that it will be relatively easy to localize the supply of most components and systems.

22 NUCLEAR REACTOR TECHNOLOGY

545 (KAERI/RR–995/91) **Development of the design safety evaluation technology.** Chae, Sung Ki (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Chang, Won Pyo; Sur, Uk Whan. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Jul 1991. 271p. (In Korean). Order Number DE93605746. Source: OSTI; NTIS (US Sales Only); INIS.

The objective of this research is to develop a deterministic and probabilistic safety assessment technology for reactor safety. As KOSAC/MOD1 which has been developed for the deterministic safety assessment and uses one dimensional, 3-equation, homogeneous thermal-hydraulic model with drift flux correlation, is an early version, so there are some limitations for its application and it has not been verified sufficiently. For its improvement and futher verification, CATHARE computer code and BETHSY experiments are also analyzed. The research areas of the probabilistic safety assessment(PSA) are development of a computer code package to perform a consistent PSA and computerized systems which aid the analysis in performance of PSA e.g., in the analysis of common-cause failure and HREP in the analysis of human reliability. A new technology such as artificial intelligence(AI) is also utilized in order to improve present PSA technique. (Author).

546 (KAERI/RR–1003/90) **The development of load-following technology in nuclear power plants.** Hwang, Woan (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Kuh, Jung Eui; Hwang, Hae Ryong. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Jul 1991. 489p. (In Korean). Order Number DE93605745. Source: OSTI; NTIS (US Sales Only); INIS.

On the 1st year of the project initiated since 1988, a feasibility study on the application of advanced load-follow technologies to domestic nuclear power plants was performed with surveying related literature operation strategy for domestic grid requirements was suggested, and associated design methodology and evaluation scheme were established. During the final year of the project, a new load-follow operation strategy for the Korean Standardized Nuclear Power Plants(KSNPPs), called Mode K, has been developed as a major part of the project. The validity of its design methodology and evaluation scheme has been evaluated through the technical consultation of Framatome. Also, the impacts of Mode K operation have been evaluated on fuel, core and system. In addition, the design requirements for Mode K operation were prepared for the commercial implementation phase. (Author).

2201 Theory and Calculation

Refer also to citation(s) 466, 517, 521, 593, 674, 1253, 2428, 2431, 2432, 2447, 2448, 2449

547 (AECL–10146-1) **Validation of KENO V.a for criticality safety calculations of low-enriched uranium-235 systems.** McCamis, R.H. Atomic Energy of Canada Ltd., Pinawa, MB (Canada). Whiteshell Nuclear Research Establishment. Feb 1991. 32p. Order Number DE93603802. Source: OSTI; NTIS (US Sales Only); INIS.

The criticality safety analysis program KENO V.a, together with a 27-energy-group ENDF/B-IV criticality safety cross-section library, has been validated by comparison of calculations with the experimental results from critical benchmarks dealing with low-enriched ($\leq$ 5 wt%) ^{235}U systems, obtained both from the literature and from recent AECL Research experiments with the SLOWPOKE Demonstration Reactor. The combination of the code and this data library is shown to be very suitable for criticality safety analyses of low-enriched ^{235}U systems, with mean values of the calculated reactivities being within 1% of the experimental values. (6 figs., 3 tabs., 37 refs.).

548 (AECL–10146-2) **Validation of KENO V.a for criticality safety calculations involving WR-1 fast-neutron fuel arrangements.** Gauld, I.C. Atomic Energy of Canada Ltd., Pinawa, MB (Canada). Whiteshell Nuclear Research Establishment. Jul 1991. 24p. Order Number DE93603803. Source: OSTI; NTIS (US Sales Only); INIS.

The KENO V.a criticality safety code, used with the SCALE 27-energy-group ENDF/B-IV-based cross-section library, has been validated for low-enriched uranium carbide (UC) WR-1 fast-neutron (FN) fuel arrangements. Because of a lack of relevant experimental data for UC fuel in the published literature, the validation is based primarily on calculational comparisons with critical experiments for fuel types with a range of enrichments and densities that cover those of the FN UC fuel. The ability of KENO V.a to handle the unique annular pin arrangement of the WR-1 FN fuel bundle was established using a comparison with the MCNP3B code used with a continuous-energy ENDF/B-V-based cross-section library. This report is part of the AECL–10146 report series documenting the validation of the KENO V.a criticality safety code.

549 (IGC–120) **Activity report of Reactor Physics Division : 1990.** Mohanakrishnan, P. (ed.). Indira Gandhi Centre for Atomic Research, Kalpakkam (India). 1991. 118p. Order Number DE93605747. Source: OSTI; NTIS (US Sales Only); INIS.

The major Research and Development and Project activities carried out during the year 1990 in Reactor Physics Division are presented in the form of summaries in this report. The various activities are organised under the following areas : (1) Nuclear Data Evaluation, Processing and Validation, (2) Core Physics and Analysis, (3) Reactor Kinetics and Safety Analysis, (4) Noise Analysis, and (5) Radiation Transport and Shielding. FBTR was restarted in July 1990 and the power was raised upto 500 kW. A number of low power physics experiments on reactivity coefficients, kinetics and noise, neutron flux and gamma dose in B cells, were performed, which are discussed in this report. (author). figs., tabs.

550 (INIS-BR–2942, pp. 36) **Spatial kinetics coupled to the simulator.** Santo, A.C.F. de (Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Div. de Fisica de Reatores). Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1989. 147p. (In Portuguese). In *Triennial technical report - 1986, 1987, 1988 - Instituto de Engenharia Nuclear (IEN) -Dept. of Reactors (DERE).* Order Number DE93605069. Source: OSTI; NTIS (US Sales Only); INIS.

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Published in summary form only. REACTOR SIMULATORS/ reactor kinetics; ACCURACY; ASYMPTOTIC SOLUTIONS; COMPUTERIZED SIMULATION; NEUTRON FLUX; OPTIMIZATION; TIME DEPENDENCE; TRANSIENTS

551 (INIS-BR–2942, pp. 37) **Study on fast neutrons moderation in polyethylene and paraffin from a ^{241} Am-Be (α, n) source.** Renke, C.A.C. (Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Div. de Fisica de Reatores). Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1989. 147p. (In Portuguese). In *Triennial technical report - 1986, 1987, 1988 - Instituto de Engenharia Nuclear (IEN) -Dept.*

of Reactors (DERE). Order Number DE93605069. Source: OSTI; NTIS (US Sales Only); INIS.

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Published in summary form only. FAST NEUTRONS/paraffin; FAST NEUTRONS/polyethylenes; A CODES; AMERICIUM 241; BERYLLIUM; CROSS SECTIONS; PARAFFIN; POLYETHYLENES; MODERATORS; NEUTRON SPECTRA; SPHERES; THERMALIZATION

552 (KAERI/RR–1071/91) **Nuclear data evaluation and group constant generation for reactor analysis.** Kim, Jung Do (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Lee, Jong Tae; Min, Byung Joo; Gil, Choong Sup. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Jan 1991. 100p. (In Korean). Order Number DE93605748. Source: OSTI; NTIS (US Sales Only); INIS.

In nuclear or shielding design analysis for reactors or other facilities, nuclear data are one of the primary importances. Research project for nuclear data evaluation and their effective applications has been continuously performed. The objectives of this project are (1) to compile the latest evaluated nuclear data files, (2) to establish their processing code systems, and (3) to evaluate the multigroup constant library using the newly compiled data files and the code systems. As the results of this project, ENDF/B-VI Supplementary File including important nuclides, JENDL-3.1 and JEF-1 were compiled, and ENDF-6 international computer file format for evaluated nuclear data and its processing system NJOY89.31 were tested with ENDF/B-VI data. In order to test an applicability of the newly released data to thermal reactor problems, a number of benchmark calculations were performed, and the results were analyzed. Since preliminary benchmark testing of thermal reactor problems have been made the newly compiled data are expected to be positively used to develop advanced reactors. (Author).

2202 Components and Accessories

Refer also to citation(s) 722, 723, 724, 726, 980, 1242, 1245, 1248

553 (BNL–47071) **Independent verification of tank volume measurements by pressure-volume authentication.** Suda, S.C.; Keisch, B. Brookhaven National Lab., Upton, NY (United States). [1992]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (TSO–92-1;CONF-9207102–68: Institute of Nuclear Materials Management (INMM) annual meeting, Orlando, FL (United States), 19-22 Jul 1992). Order Number DE92040680. Source: OSTI; NTIS; INIS; GPO Dep.

Brookhaven National Laboratory has developed a portable pressure-volume authenticator** as a standard and means of checking the functionality and quality of bubbler-probe volumetric devices. The pressure-volume authenticator (PVA) consists of an automated electromanometer system that is controlled by a laptop computer, and a transportable volumetric artifact. A portable pressure gage is connected, via a scanivalve, to the operator's bubbler-probe system and independently measures all bubbler probes. The transportable volumetric artifact is a one-meter high vessel equipped with bubble-probes, computer controlled air-purge rotameters, and platinum resistance (RTD) thermometer. High quality measurements are obtained by use of a fast sampling technique and sophisticated software developed under this program. The computer software performs the following functions: (a) instrument control, (b) data acquisition, (c) on-line graphical and numerical display of measurement data, and (d) detailed data analysis. The device also may provide hands-on training for inspectors and plant operators in high quality volumetric data collection and analysis. A field demonstration of the automated electromanometer system was conducted on the PETRA input accountancy tank, JRC-Ispra in November 1991.

554 (CEA-CONF–10965) **Presentation of the Fabrice process: validation by the Prisca experiments and refabrication experience up to 1991.** Blanc, J.Y.; Vouillot, M.; Royer, J. CEA Centre d'Etudes de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Mecanique et de Technologie. 1992. 16p. (CONF-9205116–: International conference on irradiation technology, Saclay (France), 20-22 May 1992). Order Number DE93721208. Source: OSTI; NTIS (US Sales Only); INIS.

This paper is intended to update the manufacturing experience in the FABRICE process used in SETIC/LECR for refabrication of short fuel rods for ramp testing. It includes the document written in August 1986 by Mr. Jacques ROYER on qualification of FABRICE rods during PRISCA experiments. The updating is constituted by the list of the rods manufactured up to 1991, and by some technical considerations on this process.

555 (DOE/ER/13030–2) **Damage dosimetry and embrittlement monitoring of nuclear pressure vessels in real time by magnetic properties measurement: Technical progress report for year 2, October 1, 1991–September 30, 1992.** Stubbins, J.F.; Ougouag, A.M.; Williams, J.G. Illinois Univ., Urbana, IL (United States). Dept. of Nuclear Engineering. 1 Jul 1992. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-90ER13030. Order Number DE93000422. Source: OSTI; NTIS; GPO Dep.

The objective of this project is to develop a technique for real-time monitoring of neutron dose and of the onset and progression of embrittlement in operating nuclear pressure vessels. The technique relies on the measurement of magnetic properties of steel and other magnetic materials which are extremely sensitive to radiation-induced properties changes. The approach being developed here is innovative and unique. It promises to be readily applicable to all existing and planned reactor structures. The significance of this program is that it addresses a major concern in the operation of existing nuclear pressure vessels. The development of microscopic defect clusters during irradiation in the nuclear pressure vessel beltline region leads to an increase in material yield strength and a concomitant decrease in ductility, or ability to absorb energy in fracture (i.e. fracture toughness). This decrease in fracture toughness is alarming since it may impair the ability of the pressure vessel to resist fracture during unusual loading situations.

556 (EUR–14039, pp. 114-120) **Hydrogen risk: studies about detonation phenomena via Plexus code.** Forestier, A.J. (CEA Centre d'Etudes de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Mecanique et de Technologie). Commission of the European Communities, Luxembourg (Luxembourg). 1992. (CONF-9103264–: Proceedings of a Workshop on Hydrogen behaviour and mitigation in water-cooled nuclear power reactors, Brussels (Belgium), 4-8 Mar 1991). In *Hydrogen behaviour and mitigation in water-cooled nuclear power reactors.* 370p. Order Number DE93721166. Source: OSTI; NTIS (US Sales Only); INIS.

The hydrogen risk in nuclear reactor is an extensive field of study which includes several aspects like burning via deflagrations or detonations and containment integrity. An extensive amount of work has already been devoted to this problem. The scope of this paper is to present some subjects related to hydrogen risk which are in progress at CEA/DMT, associated to computation of detonation shock waves in confined or semi-confined volumes and the resulting impulsive load on the containments.

557 (EUR–14039, pp. 121-128) **Deflagration tests of an air-hydrogen-steam mixture with not uniformly distributed steam.** Carcassi, M.N. (Pisa Univ. (Italy). Dipt. di Costruzioni Meccaniche e Nucleari). Commission of the European Communities, Luxembourg (Luxembourg). 1992. (CONF-9103264–: Proceedings of a Workshop on Hydrogen behaviour and mitigation in water-cooled nuclear power reactors, Brussels (Belgium), 4-8 Mar 1991). In *Hydrogen behaviour and mitigation in water-cooled nuclear power reactors.* 370p. Order Number DE93721166. Source: OSTI; NTIS (US Sales Only); INIS.

Almost all the experimental tests carried out around the world to investigate the behaviour of a combustion of air-hydrogen-steam mixture, have been made with a uniform mixture. In the case of a severe accident of a nuclear reactor with production of hydrogen, inside the containment of the reactor, the air-hydrogen-steam mixture might be not uniform, for example in the case were containment spray fails to work. This behaviour is clearly showed in the HDR experiments were stratification were found during the experiments. To examine this aspect a series of 10 tests was undertaken at the Department of Mechanical and Nuclear Constructions of the University of Pisa. The experimental apparatus

used was the HYDRO-SH (a small apparatus of 0.5 m^3), whereas in the past almost 100 tests of combustion of air-hydrogen-steam mixture uniformly distributed were done. The new test data was compared with the previous tests in terms of pressure efficiencies. The preliminary results show that with a steam concentration less than 30% no difference exist between the new and the old tests. With a steam concentration of 50% the pressure efficiencies of tests with not uniformly distributed steam is greater than equivalent test where the steam was well distributed.

558 (EUR–14039, pp. 129-140) **Flame acceleration in hydrogen/air/steam mixtures in the presence of repeated obstacles in a closed volume.** Kumar, R.K. (Atomic Energy of Canada Ltd., Pinawa, MB (Canada). Whiteshell Nuclear Research Establishment); Bowles, E.M. Commission of the European Communities, Luxembourg (Luxembourg). 1992. (CONF-9103264–: Proceedings of a Workshop on Hydrogen behaviour and mitigation in water-cooled nuclear power reactors, Brussels (Belgium), 4-8 Mar 1991). In *Hydrogen behaviour and mitigation in water-cooled nuclear power reactors.* 370p. Order Number DE93721166. Source: OSTI; NTIS (US Sales Only); INIS.

Experiments were carried out in a 5.7-m high, 1.5-m diameter cylindrical vessel to determine the effect of obstacles in the flame path on the flame speed and peak pressure. The experiments were performed at 100 kPa and 128 deg C with hydrogen/air/steam mixtures containing 12 to 20% hydrogen and up to 30% steam by volume. For a given hydrogen concentration, the results indicate that the flame speed and the peak pressures decrease as the steam concentration increases. The extent of reduction in flame speed, however, depends on the hydrogen concentration. The mitigating effect of steam on the flame acceleration is highest at low hydrogen concentrations and least at high hydrogen concentrations.

559 (EUR–14039, pp. 240-246) **Concept and qualification of a combined system for hydrogen mitigation after severe accidents.** Heck, R. (Siemens AG Unternehmensbereich KWU, Offenbach am Main (Germany)). Commission of the European Communities, Luxembourg (Luxembourg). 1992. (CONF-9103264–: Proceedings of a Workshop on Hydrogen behaviour and mitigation in water-cooled nuclear power reactors, Brussels (Belgium), 4-8 Mar 1991). In *Hydrogen behaviour and mitigation in water-cooled nuclear power reactors.* 370p. Order Number DE93721166. Source: OSTI; NTIS (US Sales Only); INIS.

Pursuant to the current discussion regarding options for reducing the risk of loss of containment integrity following a severe accident, this report describes the concepts of controlled ignition and catalytic recombination. The current status of these two concepts is presented and an evaluation performed of their possible applications.

560 (EUR–14039, pp. 274-285) **The reaction between H_2 and O_2 over tungsten carbide catalysts.** Guskey, G.J. (Stanford Univ., CA (United States)); Boudart, M.; Frennet, A. Commission of the European Communities, Luxembourg (Luxembourg). 1992. (CONF-9103264–: Proceedings of a Workshop on Hydrogen behaviour and mitigation in water-cooled nuclear power reactors, Brussels (Belgium), 4-8 Mar 1991). In *Hydrogen behaviour and mitigation in water-cooled nuclear power reactors.* 370p. Order Number DE93721166. Source: OSTI; NTIS (US Sales Only); INIS.

The stationary-state reaction between H_2 and O_2 either in excess H_2 or O_2 has been studied in a flow recirculation reactor over unsupported powders of tungsten carbide with high specific surface area and microporous texture for up to 40 h. Areal rates, v_a are first order in the concentration of the limiting reactant and zero order in the concentration of the excess reactant between 273 and 600 K and near atmospheric pressure. Rates are referred to the number of sites counted by titration of preadsorbed oxygen with H_2 at room temperature. This number is multiplied by the surface area per W atom to obtain v_a. These tungsten carbides exhibit a microporous structure. A break in the Arrhenius diagram near 450 K is observed. Below 450 K either in excess H_2 or O_2 capillary condensation of product water causes the micropores of the catalyst to become blocked. Thus, the reaction occurs only in the mesopores which account for about 10% of the total specific surface area, S_g. Above 450 K, water leaves the micropores and the apparent v_a increases as active sites within the micropores become accessible to the reactants. In excess O_2 at 273 K, the first order rate constant of v_a based on active area of mesopores, is two times higher for microporous αWC than that for platinum.

561 (EUR–14039, pp. 286-296) **Hydrogen mitigation using catalyst modules.** Behrens, U. (Battelle-Institut e.V., Frankfurt am Main (Germany)); Seidler, M.; Wolff, U. Commission of the European Communities, Luxembourg (Luxembourg). 1992. (CONF-9103264–: Proceedings of a Workshop on Hydrogen behaviour and mitigation in water-cooled nuclear power reactors, Brussels (Belgium), 4-8 Mar 1991). In *Hydrogen behaviour and mitigation in water-cooled nuclear power reactors.* 370p. Order Number DE93721166. Source: OSTI; NTIS (US Sales Only); INIS.

Large amounts of hydrogen may be released into the containment atmosphere of a nuclear plant during a postulated loss-of-coolant accident (LOCA). NIS has developed, at the request of RWE-Energie AG, a catalyst module that is designed to mitigate the released hydrogen sufficiently, provided a large number of these modules are suitably located inside the containment. In this way, during an accident, hydrogen concentration will essentially remain below the limit of inflammability. Containment malfunction due to hydrogen combustion may therefore be ruled out.

562 (EUR–14039, pp. 305-316) **Removal of hydrogen with catalytic recombiners during severe accident situations.** Chakraborty, A.K. (Gesellschaft fuer Reaktorsicherheit mbH (GRS), Koeln (Germany)). Commission of the European Communities, Luxembourg (Luxembourg). 1992. (CONF-9103264–: Proceedings of a Workshop on Hydrogen behaviour and mitigation in water-cooled nuclear power reactors, Brussels (Belgium), 4-8 Mar 1991). In *Hydrogen behaviour and mitigation in water-cooled nuclear power reactors.* 370p. Order Number DE93721166. Source: OSTI; NTIS (US Sales Only); INIS.

A passive device based on the catalytic transformation of hydrogen to water, a recombiner has been conceptually designed to reduce the potential danger of hydrogen burn in the containment during severe accidents. Extensive experiments on small and large scale under temperature, pressure and atmospheric conditions simulating the severe accident situations revealed positive results even in the presence of catalytic poisons like CO, I and Cs_2CO_3 and aerosols. The application of catalytic recombiners is associated with numerous advantages like the promotion of convection, dissolution of stratified layers, and protection of the functionability of instruments by preventing burns. This paper is going to address some of the results derived from the experiments on catalytic recombination of hydrogen and oxygen from air.

563 (EUR–14039, pp. 317-323) **Catalytic removal of hydrogen in humid, hydrogen-air gas streams.** Koroll, G.W. (Atomic Energy of Canada Ltd., Pinawa, MB (Canada). Whiteshell Nuclear Research Establishment); Lau, D.; Graham, W.R.C. Commission of the European Communities, Luxembourg (Luxembourg). 1992. (CONF-9103264–: Proceedings of a Workshop on Hydrogen behaviour and mitigation in water-cooled nuclear power reactors, Brussels (Belgium), 4-8 Mar 1991). In *Hydrogen behaviour and mitigation in water-cooled nuclear power reactors.* 370p. Order Number DE93721166. Source: OSTI; NTIS (US Sales Only); INIS.

Performance tests are described of a wetproofed catalytic hydrogen recombiner in humid and condensing forced-air streams. The catalyst element, of AECL design, shows good resistance to water and achieves conversion efficiencies approaching 100% for hydrogen concentrations as low as 1% with gas residence times in the catalyst element of 100 ms or less. In these terms, the catalyst appears capable of high- throughput hydrogen removal in a post-accident containment atmosphere.

564 (INFO–0316) **Assessment of IAEA safety series no. 75-INSAG-3 - "basic safety principles for nuclear power plants".** Atomic Energy Control Board, Ottawa, ON (Canada). Advisory Committee on Nuclear Safety. Jan 1989. 28p. (In English, French). (ACNS–16;CCSN–16.). Order Number DE93603807. Source: OSTI; NTIS (US Sales Only); INIS.

The International Atomic Energy Agency Safety Series No. 75-INSAG–3, 'Basic Safety Principles for Nuclear Power Plants' is reviewed in the light of the Advisory Committee on Nuclear Safety reports ACNS–2, 'Safety Objectives for Nuclear Activities in

Canada', and ACNS–4, 'Recommended General Safety Requirements for Nuclear Power Plants'. The INSAG safety objectives are consistent with the safety objectives stated in ACNS–2 but are less general, applying only to nuclear power plants. The INSAG safety principles are, in general, consistent with the requirements stated in ACNS–4 but put more emphasis on 'safety culture'. They give little attention to reactor plant effluents, waste management, or decommissioning. (fig., 5 refs.).

565 (INIS-BR–2942, pp. 54) **Experimental evaluation of the TV-CTS-1 code for thermohydraulic parameters calculation of CTS-1 thermal sodium loop.** Cesar, S.B.G. (Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores); Araujo, F.G.B. de. Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1989. 147p. (In Portuguese). In *Triennial technical report - 1986, 1987, 1988 - Instituto de Engenharia Nuclear (IEN) -Dept. of Reactors (DERE).* Order Number DE93605069. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. COOLANT LOOPS/computerized simulation; COOLANT LOOPS/sodium; SODIUM; HEATERS; RESISTORS; T CODES; TEMPERATURE DEPENDENCE; THERMODYNAMICS

566 (INIS-BR–2942, pp. 55) **Reduction of execution time of the program for the calculation of natural convection transients at CTS-1 sodium loop.** Walsh, L.M. (Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores). Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1989. 147p. (In Portuguese). In *Triennial technical report - 1986, 1987, 1988 - Instituto de Engenharia Nuclear (IEN) -Dept. of Reactors (DERE).* Order Number DE93605069. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. COOLANT LOOPS/programming; COOLANT LOOPS/sodium; COMPUTER CALCULATIONS; PROGRAMMING; SODIUM; FINITE DIFFERENCE METHOD; FORTRAN; NATURAL CONVECTION; TIME DEPENDENCE; TRANSIENTS

567 (INIS-BR–2942, pp. 55-56) **Calculation of drainage time for sodium loops.** Walsh, L.M. (Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores). Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1989. 147p. (In Portuguese). In *Triennial technical report - 1986, 1987, 1988 - Instituto de Engenharia Nuclear (IEN) -Dept. of Reactors (DERE).* Order Number DE93605069. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. COOLANT LOOPS/drainage; COOLANT LOOPS/sodium; CLASSICAL MECHANICS; COMPUTER CALCULATIONS; DRAINAGE; SODIUM; FLOW RATE; MATHEMATICAL MODELS; TIME DEPENDENCE

568 (INIS-BR–2942, pp. 59) **Design and construction of a filling and drainage system for the water loop.** Bloch, M. (Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores); Morgado, A. Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1989. 147p. (In Portuguese). In *Triennial technical report - 1986, 1987, 1988 - Instituto de Engenharia Nuclear (IEN) -Dept. of Reactors (DERE).* Order Number DE93605069. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. COOLANT LOOPS/drainage; COOLANT LOOPS/water; DRAINAGE; WATER; PUMPS; SPECIFICATIONS

569 (INIS-BR–2942, pp. 60-62) **Operation and maintenance of the CTS-1 sodium loop.** Barbosa, A.L.N. (Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores); Pinto, A.J.R.; Mprgado, A. Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1989. 147p. (In Portuguese). In *Triennial technical report - 1986, 1987, 1988 - Instituto de Engenharia Nuclear (IEN) -Dept. of Reactors (DERE).* Order Number DE93605069. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. COOLANT LOOPS/maintenance; COOLANT LOOPS/operation; MAINTENANCE; OPERATION; CORROSION; EDUCATION; MODIFICATIONS; REPAIR; RESISTORS; SODIUM

570 (INIS-BR–2942, pp. 62-63) **Thermal deformation analysis in scale model of the CTS-1 sodium loop.** Nagy, G.P. (Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores). Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1989. 147p. (In Portuguese). In *Triennial technical report - 1986, 1987, 1988 - Instituto de Engenharia Nuclear (IEN) -Dept. of Reactors (DERE).* Order Number DE93605069. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. COOLANT LOOPS/scale models; PIPELINES/deformation; CALIBRATION; PHOTOGRAPHY; PIPELINES; DEFORMATION; SODIUM; TEMPERATURE DEPENDENCE

571 (INIS-BR–2942, pp. 65) **Calculation of CTS-1 thermal insulation.** Cesar, S.B.G. (Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores). Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1989. 147p. (In Portuguese). In *Triennial technical report - 1986, 1987, 1988 - Instituto de Engenharia Nuclear (IEN) -Dept. of Reactors (DERE).* Order Number DE93605069. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. COOLANT LOOPS/thermal insulation; THERMAL INSULATION/thickness gages; COMPUTER CALCULATIONS; SODIUM; TEMPERATURE DEPENDENCE

572 (INIS-BR–2942, pp. 66-67) **Compatibility study of magnesium oxide with sodium.** Castro Moreira, L.Q. de (Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores). Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1989. 147p. (In Portuguese). In *Triennial technical report - 1986, 1987, 1988 - Instituto de Engenharia Nuclear (IEN) -Dept. of Reactors (DERE).* Order Number DE93605069. Source: OSTI; NTIS (US Sales Only); INIS.

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Published in summary form only. COOLANT LOOPS/sodium; SODIUM/magnesium oxides; ACCIDENTS; CHEMICAL REACTIONS; SODIUM; RESISTORS; THERMAL INSULATION

573 (INIS-BR–2942, pp. 72) **Safety instruction for CTS-1 sodium thermal circuit operation.** Costa, A.M.P. da (Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores). Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1989. 147p. (In Portuguese). In *Triennial technical report - 1986, 1987, 1988 - Instituto de Engenharia Nuclear (IEN) -Dept. of Reactors (DERE).* Order Number DE93605069. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. COOLANT LOOPS/emergency plans; COOLANT LOOPS/operation; OPERATION; FIRE EXTINGUISHERS; PERSONNEL; SAFETY STANDARDS; SODIUM

574 (INIS-BR–2942, pp. 79-80) **Preparation for assembling of the new sodium loops.** Bellini, I.W. (Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores); Silva Porto, F.G. da. Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1989. 147p. (In Portuguese). In *Triennial technical report - 1986, 1987, 1988 - Instituto de Engenharia Nuclear (IEN) -Dept. of Reactors (DERE).* Order Number DE93605069. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. COOLANT LOOPS/construction; COOLANT LOOPS/quality assurance; CONSTRUCTION; EDUCATION; QUALITY CONTROL; SODIUM

575 (INIS-BR–2942, pp. 82) **Verification of the control quality documentation of the new sodium loops of IEN (Nuclear Engineering Institute).** Costa, A.M.P. da (Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores). Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1989. 147p. (In Portuguese). In *Triennial technical report - 1986, 1987, 1988 - Instituto de Engenharia Nuclear (IEN) -Dept. of Reactors (DERE).* Order Number DE93605069. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. COOLANT LOOPS/quality control; COOLANT LOOPS/welding; WELDING/documentation;

WELDING; NONDESTRUCTIVE TESTING; SODIUM; WELDED JOINTS; DOCUMENTATION

576 (INIS-BR–2942, pp. 95) **Elastoplastic adaptation applied to shell structure.** Jospin, R.J. (Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores). Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1989. 147p. (In Portuguese). In *Triennial technical report - 1986, 1987, 1988 - Instituto de Engenharia Nuclear (IEN) -Dept. of Reactors (DERE).* Order Number DE93605069. Source: OSTI; NTIS (US Sales Only); INIS.

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Published in summary form only. SHELLS/stress analysis; DEFORMATION; ELASTICITY; PLASTICITY; SHELLS

577 (INIS-BR–2942, pp. 125-126) **Analysis of pressure waves propagation in hydraulic circuits for thermal shock with sodium.** Botelho, D.A. (Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Div. de Termohidraulica de Reatores). Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1989. 147p. (In Portuguese). In *Triennial technical report - 1986, 1987, 1988 - Instituto de Engenharia Nuclear (IEN) -Dept. of Reactors (DERE).* Order Number DE93605069. Source: OSTI; NTIS (US Sales Only); INIS.

Published in full form as CT-IEN-DERE-DITRE 02/88.

Published in summary form only. COOLANT LOOPS/sodium; COOLANT LOOPS/thermal shock; COOLANT LOOPS/wave propagation; CONTINUITY EQUATIONS; SODIUM; ELASTICITY; ONE-DIMENSIONAL CALCULATIONS; PIPELINES

578 (KAERI/RR–1048/91) **The development of detection technique for fatigue crack due to thermal stratification phenomena in RCS piping.** Lee, Sam Lai (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Kim, Byoung Chul; Lim, Hyung Taik; Lee, Jong Po; Chang, Kee Ok. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Jan 1992. 89p. (In Korean). Order Number DE93605749. Source: OSTI; NTIS (US Sales Only); INIS.

Piping stress analysis has been performed using computer code ANSYS in order to find the stress profile considering thermal stratification phenomena. This kind of analysis can be a useful tool to assist inspection engineer to choose right method and area of inspection during in-service inspection of nuclear power plants. Mechanical fatigue cracks have been generated in order to improve detection reliability of defect ultrasonically since the defects that have been searched for are mostly related to fatigue cracks in pressurized water reactors. (Author).

579 (KAERI/RR–1053/91) **Permanent pool cavity seal design development.** Kim, In Yong (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Kim, Bum Sik; Shin, Tae Myung; Lee, Moon Ok; Lee, Kyu Man. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Feb 1992. 78p. (In Korean). Order Number DE93605750. Source: OSTI; NTIS (US Sales Only); INIS.

The existing pool cavity seal assembly design of every Korean Nuclear Power Plant and the state-of-art of the PPS development of the foreign NSSS suppliers were surveyed, and the design requirements for PPS were established using those for YGN 3 and 4 as reference. The optimization technique is applied in order to get the best sectional shape which can minimize maximum stress under the design loads. The stress analysis and the fatigue analysis of the developed PPS were carried out for the loads of each plant condition to evaluate the integrity during the plant lifetime. At the same time the structural design was compared to those of the PPS of the foreign NSSS suppliers. (Author).

580 (KAERI/RR–1080/91) **Development of operating transients monitoring system for primary components of nuclear power plants.** Kwack, Eun Ho (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Sur, Uk Hwan. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Jan 1992. 159p. (In Korean). Order Number DE93605751. Source: OSTI; NTIS (US Sales Only), INIS.

In this study, the application of on-line fatigue monitoring system for tracking fatigue usage in operating nuclear power plants is described. The system, which uses Green's function approach, can operate on microcomputer like IBM compatible personal computers. Since the developed system can be used to automatically compute cumulative fatigue usage in real time and estimate the integrity of a plant during plant operation, this system provides an important information for design improvement and contributes to plant life extension. The Green's function approach shows good agreement with conventional finite element analysis and contributes to improving solution technique for transient thermal stress problems for use in real time fatigue monitoring. The approach shows a remarkable reduction in computation time compared with finite element technique. The system enables optimization of the inspection, maintenance and replacement, and will ultimately contribute to plant life extension. (Author).

581 (KAERI/RR–1082/91) **Study on the irradiation damage in the reactor component materials.** Choi, Sun Pil (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Choi, Kwon Jae; Park, Moon Ho; Kang, Sang Shim. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Feb 1992. 52p. (In Korean). Order Number DE93605752. Source: OSTI; NTIS (US Sales Only); INIS.

The charpy impact test has been studied and a theoretical expression for analyzing charpy impact test data was deduced and called the KAERI method. A number of surveillance data(the irradiated charpy data) were analyzed by the KAERI method and we obtained the results that (1) all the charpy impact data have shown the Debye characteristics, (2) the activation energy has unique values and changes to other values by step after irradiation, (3) the characteristic temperature, a measure of brittleness, varies in a wide range of temperature depending upon the heat treatment conditions, and (4) the radiation embrittlement should be studied systematically by a traditional method such as the internal friction. (Author).

582 (NUREG/CP–0122-Vol.2) **Aging research information conference: Proceedings: Volume 2.** Beranek, A. (comp.). Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. Sep 1992. 461p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). (CONF-920375–Vol.2: Aging research information conference, Rockville, MD (United States), 24-27 Mar 1992). Source: OSTI; NTIS; INIS; GPO.

This conference was held to disseminate research results in the area of nuclear power plant aging from programs sponsored by the Office of Nuclear Regulatory Research, US Nuclear Regulatory Commission. The conference also provided an opportunity for engineers and scientists from around the world to exchange technical information and discuss future international cooperation. The papers and talks appear in the order in which they were presented at the conference, and they are grouped by technical session in two volumes. Volume 1 contains the proceedings of March 24 and 25, while Volume 2 contains the proceedings of March 26 and 27. Volume 2 contains 21 papers and a panel discussion. The papers are processed separately for the database.

583 (NUREG/CR–5121) **Experimental results from pressure testing a 1:6-scale nuclear power plant containment.** Horschel, D.S. (Sandia National Labs., Albuquerque, NM (United States)). Nuclear Regulatory Commission, Washington, DC (United States). Div. of Engineering; Sandia National Labs., Albuquerque, NM (United States). Jan 1992. 142p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC04-76DP00789. (SAND–88-0906). Source: OSTI; NTIS; INIS; GPO.

Includes 27 sheets of 24x reduction microfiche.

This report discusses the testing of a 1:6-scale, reinforced-concrete containment building at Sandia National Laboratories, in Albuquerque, New Mexico. The scale-model, Light Water Reactor (LWR) containment building was designed and built to the American Society of Mechanical Engineers (ASME) code by United Engineers and Constructors, Inc., and was instrumented with over 1200 transducers to prepare for the test. The containment model was tested to failure to determine its response to static internal

overpressurization. As part of the US Nuclear Regulatory Commission's program on containment integrity, the test results will be used to assess the capability of analytical methods to predict the performance of containments under severe-accident loads. The scaled dimensions of the cylindrical wall and hemispherical dome were typical of a full-size containment. Other typical features included in the heavily reinforced model were equipment hatches, personnel air locks, several small piping penetrations, and a ihin steel liner that was attached to the concrete by headed studs. In addition to the transducers attached to the model, an acoustic detection system and several video and still cameras were used during testing to gather data and to aid in the conduct of the test. The model and its instrumentation are briefly discussed, and is followed by the testing procedures and measured response of the containment model. A summary discussion is included to aid in understanding the significance of the test as it applies to real world reinforced concrete containment structures. The data gathered during SIT and overpressure testing are included as an appendix.

584 (NUREG/CR–5416) **Technical evaluation of Generic Issue 113: Dynamic qualification and testing of large bore hydraulic snubbers.** Nitzel, M.E. (EG and G Idaho, Inc., Idaho Falls, ID (United States)); Ware, A.G.; Page, J.D. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Safety Issue Resolution; EG and G Idaho, Inc., Idaho Falls, ID (United States). Sep 1992. 402p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC07-76ID01570. (EGG–2571). Source: OSTI; NTIS; INIS; GPO.

This report summarizes the work performed by the Idaho National Engineering Laboratory (INEL) for the Nuclear Regulatory Commission to resolve Generic Issue 113, "Dynamic Qualification and Testing of Large Bore Hydraulic Snubbers (LBHSs)." The report evaluates LBHS reliability and the need to improve that reliability. The INEL gathered and reviewed information regarding snubber (including LBHS) numbers and uses, design, environmental qualification, operating experience, and the effects of various snubber reduction programs. Limited qualitative and quantitative analyses were performed regarding potential LBHS single failures. A list of potential improvements to LBHS reliability was generated and each item on the list was evaluated by probabilistic risk and cost/benefit analyses. Eleven recommendations were made; five applicable to existing and future plants, five applicable only to future plants, and one for further "single-failure" research.

2203 Fuel Elements

Refer also to citation(s) 165, 516, 646, 653, 655, 656, 657, 658, 659, 660, 661, 662, 665, 667, 671, 672, 979, 1254, 2437, 2440, 2441

585 (DPW–5423) **New fuel element development: Trip report, ALCOA, New Kensington, May 5, 6, 1952.** Smith, C.D.; Huntoon, R.T. Du Pont de Nemours (E.I.) and Co., Wilmington, DE (United States). 20 May 1952. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-76SR00001. (SR/H–228). Order Number DE93001461. Source: OSTI; NTIS (US Sales Only); GPO Dep.

A trip was made to New Kensington, PA., to discuss a proposed development program for extrusion and drawing of ribbed tubes to sheath long fuel elements.(JL)

586 (DPW–5912) **Radiographic inspection of fuel slug welds equipment and program at Hanford Works.** McCrosky, R.D. Du Pont de Nemours (E.I.) and Co., Wilmington, DE (United States). Explosives Dept. 18 Jul 1952. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-76SR00001. (SR/H–212). Order Number DE93001239. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report summarizes a visit to the Hanford Works on July 15 and 16, 1952 for the x-ray radiographic inspection of fuel slug welds. (JL)

587 (INIS-mf–13349, pp. 49-50) **Damage produced in reactor's fuel can from fission fragement emission.** Dadmehr, V. (Mehshed Univ., (Iran, Islamic Republic of) Physics Group). Iranian Physics Society, Teheran (Iran, Islamic Republic of). 1991. 53p. (In Persian). (CONF-9109417–: Iran's physics conference, Isfahan (Iran, Islamic Republic of), 10 Sep 1991). In *Abstract of articles from Iran's physics conference.* Order Number DE93000811. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. FUEL CANS/fission fragments; FUEL CANS/physical radiation effects; ANGULAR DISTRIBUTION

588 (JINR-R–2-91-422) **Dependence of electronuclear characteristics on ^{239}Pu and ^{235}U concentration.** Barashenkov, V.S.; Sosnin, A.N.; Shmakov, S.Yu. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Computing Techniques and Automation. 1991. 10p. (In Russian). Order Number DE93605760. Source: OSTI; NTIS (US Sales Only); INIS.

In case of incident protons at T_p=1 GeV differential and integral characteristics of electronuclear process in uranium reactor with Na coolant, lead foretarget and different concentrations of ^{239}Pu and ^{235}U are calculated by means of the Monte-Carlo method. Addition of these nuclei greatly increases the intensity of plutonium production and heat generation. At high enrichment, if uranium blanket is not used, plutonium production stops and the system works as a intensive neutron source. 3 refs.; 8 figs.; 4 tabs.

589 (KAERI/RR–1001/90) **Development of design technology for advanced pressurized water reactor: Development of safety assessment methodology.** Chae, Sung Ki (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Cho, Sung Won; Park, Chang Kyu. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Jul 1991. 259p. (In Korean). Order Number DE93605761. Source: OSTI; NTIS (US Sales Only); INIS.

The evaluation method of containment integrity and source terms in nuclear power plant were systematized. First, PRA level 2 procedure which provides the procedures of the containment analysis was developed. The containment event tree method which can assess the severe accident phenomena, the mode of containment failure, and source terms was proposed. The new proposed CET employed simple event tree which is supported by supporting tree on quantification. It can resolve the inter-dependency between top events and/or supporting events. Some Term Code Package was selected as means of evaluation of source terms. New guidance material was prepared to help easy use of STCP. (Author).

590 (KAERI/RR–1004/90) **Development of flow test technology for nuclear fuel: Development of flow test technology for nuclear fuel.** Chung, Moon Ki (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Cha, Jong Hoi; Yang, Sun Kyu. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Jul 1991. 264p. (In Korean). Order Number DE93605762. Source: OSTI; NTIS (US Sales Only); INIS.

The objective of this project is to design and construct test facilities for the thermal-hydraulic tests required in KAERI nuclear fuel(PWR, CANDU, KMRR) development program. (Author).

591 (UJV–9667-T) **Simulation of the CORA-13 experiment by the FRAS-SFD computer code in blind conditions.** Belovsky, L.; Valach, M. Ustav Jaderneho Vyzkumu CSKAE, Rez (Czechoslovakia). May 1992. 69p. Order Number DE93605764. Source: OSTI; NTIS (US Sales Only); INIS.

The CORA-13 experiment has been chosen by OECD-CSNI as International Standard Problem No. 31 (ISP-31). The general objectives of ISP-31 were to analyze the heatup and meltdown phase of a PWR-type fuel element in the CORA facility, and to examine the predictability and correctness of the severe accident computer codes used. This report summarizes the Czechoslovak contribution to ISP-31 using the FRAS-SFD computer code. A short description of the code is presented. The behavior of a single fuel rod (simulator 3.3 of the CORA-13 bundle) was simulated between 3000 and 4500 s up to the assumed onset of relocation of molten material, which was not modeled in the code. The calculated results confirmed the characteristic feature of the CORA experiments - movement of the hot zone from the top towards the bottom of the bundle. At 4500 s the cladding was nearly completely converted to ZrO_2 in the upper half of the bundle. The fraction of UO_2 dissolved in the molten cladding reached at most approx. 4.3%. The calculation indicated a significant sensitivity to the temperature of tetragonal-to-cubic ZrO_2 transformation above which the oxidation kinetics accelerates. (author) 1 tab., 28 refs., 34 figs.

2204 Control Systems

Refer also to citation(s) 1253

592 (BARC–1991/E/021) **VME bus based microcomputer system boards.** Chandra, A.K. (Bhabha Atomic Research Centre, Bombay (India). Reactor Control Div.); Ganesh, G.; Mayya, Anuradha; Chachondia, A.S.; Premraj, M.K. Bhabha Atomic Research Centre, Bombay (India). 1991. 48p. Order Number DE93605767. Source: OSTI; NTIS (US Sales Only); INIS.

Several operator information systems for nuclear plants has been developed in the Division and these have involved extensive use of microcomputer boards for achieving various functions. Standard VME bus based boards have been developed to provide the most used functions. These boards have been fabricated and tested and used in several systems including Channel Temperature Monitoring systems, Disturbance Recording Systems etc. and are also proposed to be used in additional systems under developement. The use of standard bus and boards provides considerable savings in engineering time, prototyping, testing and evaluation costs, and maintenance support. This report desribes the various boards developed and the functions available on each. (author). 4 refs., 11 figs., 3 appendixes.

593 (DOE/ER/12824–2) **Enhancing nuclear power plant performance through the use of artificial intelligence: Second annual report, June 1, 1989–May 31, 1990.** Maren, A.J.; Miller, L.F.; Tsoukalas, L.H.; Uhrig, R.E.; Upadhyaya, B.R. Tennessee Univ., Knoxville, TN (United States). Dept. of Nuclear Engineering. 15 Jun 1990. 140p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG07-88ER12824. Order Number DE92040991. Source: OSTI; NTIS; INIS; GPO Dep.

The objective of this research is to advance the state-of-the-art of applying artificial intelligence technology (both expert systems and neural networks) to enhancing the performance (safety, efficiency, control and management) of nuclear power plants. A second, but equally important, objective is to build a broadly based critical mass of expertise in the artificial intelligence field that can be brought to bear on the technology of nuclear power plants. This means the production of graduates at the B.S., M.S., and Ph.D. levels in Nuclear Engineering and related fields. The research undertaken for this program is particularly appropriate for the M.S. theses and Ph.D. dissertations. A third objective is to transfer the technology developed to the "nuclear power community," as well as the "scientific and technological community," through publications in appropriate journals and proceedings and through presentations at national and international meetings.

594 (DOE/ER/12824–3) **Enhancing nuclear power plant performance through the use of artificial intelligence: Final (third annual) report, June 1, 1990–March 31, 1992: Part 1, Overview and publications.** Maren, A.J.; Miller, L.F.; Tsoukalas, L.H.; Uhrig, R.E.; Upadhyaya, B.R. Tennessee Univ., Knoxville, TN (United States). Dept. of Nuclear Engineering. 31 Mar 1992. 34p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG07-88ER12824. Order Number DE92040992. Source: OSTI; NTIS; INIS; GPO Dep.

The objective of this research was to advance the state-of-the-art of applying artificial intelligence technology (both expert systems and neural networks) to enhancing the performance (safety, efficiency, control and management) of nuclear power plants. A second, but equally important objective, was to build a broadly based critical mass of expertise in the artificial intelligence field that can be brought to bear on the technology of nuclear power plants.

595 (DPW–5110) **[Reactor control system design].** Wende, C.W.J. Du Pont de Nemours (E.I.) and Co., Wilmington, DE (United States). Technical Div. 9 Apr 1952. 2p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-76SR00001. (SR/H–193). Order Number DE92040432. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This memorandum provides a discussion of the origin of the shadow type control system and a description of this system is given. (FI)

596 (DPW–5333) **Control actuator design.** Church, W.S. Du Pont de Nemours (E.I.) and Co., Wilmington, DE (United States). Explosives Dept. 9 May 1952. 2p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-76SR00001. (SR/H–216). Order Number DE93001243. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This memorandum discusses the procurement of parts for control actuator mechanisms. The lack of a set design specification is discussed in regard to all reactors.

597 (ECN-RX–91-057) **Operational experiences on the Borssele nuclear power plant using computer based surveillance and diagnostic system on-line: Presented at the Symposium on Nuclear Reactor Surveillance and Diagnostics, 19-24 May 1991, Gatlingburg, Tennessee, USA.** Turkcan, E. (Netherlands Energy Research Foundation (ECN), Petten (Netherlands)); Quaadvliet, W.H.J.; Peeters, T.T.J.M.; Verhoef, J.P. Netherlands Energy Research Foundation (ECN), Petten (Netherlands). Jun 1991. 14p. (CONF-910535–: 6. specialists meeting on reactor noise (SMORN), Gatlinburg, TN (United States), 19-24 May 1991). Order Number DE93603833. Source: OSTI; NTIS; INIS.

The on-line monitoring and diagnostics system of Borssele nuclear power plant (NPP), designed and established by the ECN Energy Research Foundation, has been operating continuously since 1983. The system is extended in form of multiprocessing, multi-tasking structure performing real-time monitoring, on-line reactor parameters' calculation, data-base preparation for expert systems and providing early information on possible malfunctions even in the incipient stage making alert by passive alarms. The system realized has already been operating in the course of 7 fuel cycles of the reactor starting from start-up through normal power operation. An expert system operating on the VAX work station is added to the surveillance and diagnostics system for data base management of the observed physical parameters relevant to the NPP under supervision. The paper highlights the surveillance and diagnostic modules involved, in their actual hierarchical form in use, presents theoretical considerations applied to the design of the surveillance system together with the results obtained through the 12th to 17th fuel cycles of the NPP including start-ups and shut-downs and reveals the experience thus gained by both utility and ECN through the application of the system described. (author). 19 refs.; 4 figs.

598 (INFO–0414) **Communications involving the control room of a nuclear power plant.** MacGregor, J. (Core, Inc., Vancouver, British Columbia (Canada)); Cunningham, B.; Safayeni, F.; Duimering, R. Atomic Energy Control Board, Ottawa, ON (Canada). Apr 1992. 95p. Order Number DE93603834. Source: OSTI; NTIS (US Sales Only); INIS.

This study investigated communications within the operations component of a nuclear power plant, with a primary emphasis on control room communications. A structured interview technique was developed following preliminary interviews at the plant, and pretested at AECB headquarters. Patterns were identified from questions asked on communications links, work relationships, miscommunications, procedures, instrumentation and responses to problems. The study was an exploratory one, conducted under a limited budget, to provide background information and to identify areas for further investigation. The report offers recommendations about areas for further research.

599 (INIS-BR–2942, pp. 44-45) **Nuclear reactor design and operation strategy computation.** Jachic, J. (Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Div. de Fisica de Reatores); Waintraub, M. Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1989. 147p. (CONF-890408–: Topical meeting on advances in nuclear engineering computation and radiation shielding, Santa Fe, NM (United States), 9-13 Apr 1989). In *Triennial technical report - 1986, 1987, 1988 - Instituto de Engenharia Nuclear (IEN) -Dept. of Reactors (DERE).* Order Number DE93605069. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. REACTOR OPERATION/ burnup; CALIBRATION; COMPUTER CALCULATIONS; OPTIMIZATION; PLANNING; REACTIVITY; REACTOR CORES; BURNUP; SIMULATION

600 (INIS-BR–2942, pp. 9) **Calculation of the R.P.R. reactor control rods: current status and alternatives.** Reis Filho, P.E.G. dos (Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Div. de Fisica de Reatores); Assis, J.T. de; Moreira, F.J. Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1989. 147p. (In Portuguese). In *Triennial technical report - 1986, 1987, 1988 - Instituto de Engenharia Nuclear (IEN) -Dept. of Reactors (DERE).* Order Number DE93605069. Source: OSTI; NTIS (US Sales Only); INIS.

Published in full form as CT-DINEU 02/86.

Published in summary form only. ISOTOPE PRODUCTION REACTORS/control elements; CADMIUM ALLOYS; FUEL ELEMENTS; REACTOR CONTROL SYSTEMS; SILVER ALLOYS; SPECIFICATIONS

601 (INIS-BR–2942, pp. 10) **Study on In-Cd-Ag control bars positioning and efficacy in the R.P.R. reactor core.** Assis, J.T. de (Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Div. de Fisica de Reatores); Moreira, F.J. Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1989. 147p. (In Portuguese). In *Triennial technical report - 1986, 1987, 1988 - Instituto de Engenharia Nuclear (IEN) -Dept. of Reactors (DERE).* Order Number DE93605069. Source: OSTI; NTIS (US Sales Only); INIS.

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Published in summary form only. ISOTOPE PRODUCTION REACTORS/control elements; C CODES; CADMIUM ALLOYS; CYLINDRICAL CONFIGURATION; ERRORS; INDIUM ALLOYS; PERFORMANCE; SILVER BASE ALLOYS; X CODES

602 (INIS-BR–2942, pp. 17) **Results for R.P.R. reactor control rods (B_4C-AL).** Santo, A.C.F. de (Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Div. de Fisica de Reatores); Moreira, F.J. Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1989. 147p. (In Portuguese). In *Triennial technical report - 1986, 1987, 1988 - Instituto de Engenharia Nuclear (IEN) -Dept. of Reactors (DERE).* Order Number DE93605069. Source: OSTI; NTIS (US Sales Only); INIS.

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Published in summary form only. ISOTOPE PRODUCTION REACTORS/control elements; ISOTOPE PRODUCTION REACTORS/epithermal neutrons; ALUMINIUM; BORON; CARBON; COMPARATIVE EVALUATIONS

603 (INIS-BR–2942, pp. 18) **Neutronic analysis of the new fuel element without graphite as vertical reflector in the rods.** Moreira, F.J. (Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Div. de Fisica de Reatores). Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1989. 147p. (In Portuguese). In *Triennial technical report - 1986, 1987, 1988 - Instituto de Engenharia Nuclear (IEN) -Dept. of Reactors (DERE).* Order Number DE93605069. Source: OSTI; NTIS (US Sales Only); INIS.

Published in full form as CT-DIFIR 03/87.

Published in summary form only. ISOTOPE PRODUCTION REACTORS/fuel elements; ISOTOPE PRODUCTION REACTORS/neutron reflectors; GRAPHITE; REACTIVITY; STAINLESS STEELS; WATER; ZIRCALOY

604 (INIS-BR–2942, pp. 21) **Method of supercell dilution.** Moreira, F.J. (Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Div. de Fisica de Reatores); Reis Filho, P.E.G. dos. Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1989. 147p. (In Portuguese). In *Triennial technical report - 1986, 1987, 1988 - Instituto de Engenharia Nuclear (IEN) -Dept. of Reactors (DERE).* Order Number DE93605069. Source: OSTI; NTIS (US Sales Only); INIS.

Published in full form as CT-DIFIR 07/87.

Published in summary form only. CONTROL ELEMENTS/reactivity; CONTROL ELEMENTS/reactor cells; COMPUTER CALCULATIONS; REACTIVITY; M CODES; NEUTRON FLUX; WIGNER-SEITZ METHOD

605 (INIS-BR–2942, pp. 28) **Access to the code AD21.** Barros, R.C. de (Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Div. de Fisica de Reatores). Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1989. 147p. (In Portuguese). In *Triennial technical report - 1986, 1987, 1988 - Instituto de Engenharia Nuclear (IEN) -Dept. of Reactors (DERE).* Order Number DE93605069. Source: OSTI; NTIS (US Sales Only); INIS.

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Published in summary form only. REACTOR OPERATION/burnup; CALIBRATION; COMPUTER CALCULATIONS; OPTIMIZATION; PLANNING; REACTIVITY; REACTOR CORES; BURNUP; SIMULATION

606 (INIS-BR–2942, pp. 41-42) **Spatial interpolation in tri dimensional neutronic simulation to experimental fast reactor with control bars.** Jachic, J. (Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Div. de Fisica de Reatores). Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1989. 147p. (In Portuguese). In *Triennial technical report - 1986, 1987, 1988 - Instituto de Engenharia Nuclear (IEN) -Dept. of Reactors (DERE).* Order Number DE93605069. Source: OSTI; NTIS (US Sales Only); INIS.

To be pressented at the 7. National Meeting on Reactor Physics and Thermohydraulics, Recife, PE, Brazil, 26-28 Apr 1989.

Published in summary form only. FAST REACTORS/control elements; BURNUP; CALIBRATION; INTERPOLATION; SIMULATION; THREE-DIMENSIONAL CALCULATIONS

607 (KAERI/RR–1009/90) **Improvement of main control room.** Chae, Sung Ki (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Ham, Chang Sik; Kwon, Ki Chun. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Jul 1991. 233p. (In Korean). Order Number DE93605768. Source: OSTI; NTIS (US Sales Only); INIS.

Information display system, advanced alarm system and fiber optical communication system were developed to improve the main control room in nuclear power plant. Establishing the new hierachical information structure of plant operation data, plant overview status board(POSB) and digital indicator(DI) were designed and manufactured. The prototype advanced alarm system which employed the new alarm logics and algorithm compared with the conventional alarm system were developed and its effectiveness was proved. Optical communication system which has multi-drop feature and capability of upgrading to large-scale system by using BITBUS communication protocol which is proven technology, were developed. Reliability of that system was enhanced by using distributed control. (Author).

608 (ORNL/TM–10767) **Summary of ORNL long-term surveillance at the FFTF.** Damiano, B.; Thie, J.A. Oak Ridge National Lab., TN (United States). Aug 1992. 63p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92040618. Source: OSTI; NTIS; INIS; GPO Dep.

Oak Ridge National Laboratory has used an automated system between 1983 and 1987 to collect and analyze primary system noise data at the Fast Flux Test Facility (FFTF) located in Hanford, Washington, System operation and data handling are described, data collection efforts are summarized, and principal findings are presented.

2205 Environmental Aspects

Refer also to citation(s) 285, 710, 711, 712, 713, 715, 802, 1471, 1496, 1773

609 (INFO–210(rev.2)) **Radioactive release data from Canadian nuclear generating stations 1872-1987.** Atomic Energy Control Board, Ottawa, ON (Canada). Mar 1989. 44p. Order Number DE93603680. Source: OSTI; NTIS (US Sales Only); INIS.

All nuclear generating stations emit small quantities of radioactive effluent both into the atmosphere and in the form of liquid effluent, into the adjoining water body, be it river, lake or sea. The purpose of this document is to report on the magnitude of these emissions for each nuclear generating station in Canada and to indicate how these emissions compare with the relevant limitations imposed by

the Atomic Energy Control Board as part of its regulatory and licensing program. This report incorporates histograms indicating the annual releases of tritium in air, noble gases, iodine-131, airborne particulates, tritium in water and waterborne gross beta activity for each nuclear generating station. In addition, for Pickering NGS 'A', annual released of carbon-14 are depicted for the years 1986 and 1987. In each case the emission data are compared to the Derived Emission Limit (DEL) in order that the data may be placed in perspective. At present, only Pickering NGS 'A' is required to monitor and report carbon-14 emissions. Environmental monitoring for C-14 is conducted around the Bruce site to determine the environmental impact of its emission and whether effluent monitoring will be necessary in future years. Three nuclear generating stations have been permanently taken out of service during the last few years (Gentilly NGS-1, Douglas Point NGS and NPD NGS). Some small emissions from these sites do still occur, however, due to decontamination and decommissioning operations. (11 tabs., 26 figs.).

610 (INIS-mf–13363, pp. 85-94) **Sunshine and excessive dustiness in the Czech Republic.** Foerchtgott, J. Czechoslovak Solar Energy (Czechoslovakia); Ceske Vysoke Uceni Technicke, Prague (Czechoslovakia). 1991. 100p. (In Czech). (CONF-9107237–: Renewable energy sources '91 international conference, Prague (Czechoslovakia), 1 Jul 1991). In *Renewable energy sources '91. Part 3: Conference report, post-deadline papers.* Order Number DE93605594. Source: OSTI; NTIS (US Sales Only); INIS.

In Moravia, smog-type cloudiness is observed to increase at the expense of sunshine. Errors in the evaluation of the sunshine period, which arose from a change in the calculation technique, have been disclosed. The increasing cloudiness is related to the operation of the Dukovany and Jaslovske Bohunice nuclear power plants, whose cooling towers release large amounts of water vapor into air. (M.D.). 2 tabs., 7 refs., 8 figs.

611 (NUREG–0837-Vol.12-No.2) **NRC TLD Direct Radiation Monitoring Network: Progress report, April–June 1992: Volume 12, No. 2.** Struckmeyer, R.; McNamara, N. Nuclear Regulatory Commission, King of Prussia, PA (United States). Region I. Sep 1992. 227p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). Source: OSTI; NTIS; INIS; GPO.

This report provides the status and results of the NRC Thermoluminescent Dosimeter (TLD) Direct Radiation Monitoring Network. It presents the radiation levels measured in the vicinity of NRC licensed facilities throughout the country for the second quarter of 1992.

612 (NUREG/CR–2907-Vol.10) **Radioactive materials released from nuclear power plants: Annual report 1989: Volume 10.** Tichler, J. (Brookhaven National Lab., Upton, NY (United States)); Norden, K.; Congemi, J. Nuclear Regulatory Commission, Washington, DC (United States). Office of Information Resources Management; Brookhaven National Lab., Upton, NY (United States). Sep 1992. 329p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC02-76CH00016. (BNL-NUREG–51581-Vol.10). Source: OSTI; NTIS; INIS; GPO.

Releases of radioactive materials in airborne and liquid effluents from commercial light water reactors during 1989 have been compiled and reported. The summary data for the years 1970 through 1988 are included for comparison. Data on solid waste shipments as well as selected operating information have been included. This report supplements earlier annual reports issued by the former Atomic Energy Commission and the Nuclear Regulatory Commission. The 1989 release data are summarized in tabular form. Data covering specific radionuclides are summarized.

613 (PNWD–2017-HEDR) **Selected Hanford reactor and separations operating data for 1960–1964: Hanford Environmental Dose Reconstruction Project.** Gydesen, S.P. Pacific Northwest Lab., Richland, WA (United States). Sep 1992. 276p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93000483. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of this letter report is to reconstruct from available information that data which can be used to develop daily reactor operating history for 1960–1964. The information needed for source team calculations (as determined by the Source Terms Task Leader) were extracted and included in this report. The data on the amount of uranium dissolved by the separations plants (expressed both as tons and as MW) is also included in this compilation.

614 (SNV–3931) **Bladder-wrack (Fucus vesiculosus L) as an indicator for radionuclides in the environment of Swedish nuclear power plants.** Neumann, G.; Notter, M. Swedish Environmental Protection Agency, Solna (Sweden). 1991. 38p. Order Number DE93603681. Source: OSTI; NTIS; INIS.

Results from gamma radiation analysis of samples of bladderwrack, Fucus vesiculosus, growing in the aquatic environment of Swedish nuclear power plants, are presented. The concentrations of the main nuclides, viz. ^{60}Co, ^{58}Cu, ^{65}Zn, ^{54}Mn and ^{110}Ag, are reported. Series of samples from the environment of Ringhals (at the Swedish west coast) and of Simpevarp (at the Baltic proper) were collected during the years 1979-1982 and 1981-1982, respectively. The data for ^{60}Co and ^{65}Zn were analysed using a model correlating the concentration of radionuclides in Fucus with the corresponding discharges. Also, on a small series of ^{60}Co data from Simpevarp, a model was tried based on kinetic constants for uptake and elimination. The nuclide concentrations in Fucus as a function of the distance to the point of emission was also studied, as well as transfer factors for the different nuclides. Finally the accuracy which can be expected when using Fucus for checking discharges of radionuclides from a power plant is discussed. 15 refs., 6 figs., 11 tabs.

2206 Research, Test, Training, Production, Irradiation, Materials Testing Reactors

Refer also to citation(s) 167, 168, 169, 173, 175, 502, 595, 596, 600, 601, 602, 603, 613, 709, 710, 711, 712, 713, 714, 715, 716

615 (ANL/CP–74935) **Irradiation performance of full-length metallic IFR fuels.** Tsai, H.; Neimark, L.A. Argonne National Lab., IL (United States). Jul 1992. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-921003–8: International conference on design and safety of advanced nuclear power plants, Tokyo (Japan), 25-28 Oct 1992). Order Number DE92041095. Source: OSTI; NTIS; INIS; GPO Dep.

An assembly irradiation of 169 full-length U-Pu-Zr metallic fuel pins was successfully completed in FFTF to a goal burnup of 10 at.%. All test fuel pins maintained their cladding integrity during the irradiation. Postirradiation examination showed minimal fuel/cladding mechanical interaction and excellent stability of the fuel column. Fission-gas release was normal and consistent with the existing data base from irradiation testing of shorter metallic fuel pins in EBR-II.

616 (DPSP–58-814) **Moderator studies.** Longtin, F.B. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (United States)); Taylor, J. Du Pont de Nemours (E.I.) and Co., Aiken, SC (United States). 19 May 1958. 72p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. (RTR–85). Order Number DE92040821. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Since Jan. 1957, a substantial amount of moderator data have been collected and the technical aspects of the Moderator Studies program have been reevaluate. Reappraisal of the program shows that the major phases should consist of the following: development of a complete battery of adequate methods of moderator analysis; determination of normal values and trends of each of the quantities measured; evaluation of the net rate of introduction of each moderator impurity in terms of process variables and impurity concentrations; setting acceptable limits on impurity concentrations; and development of control methods. The development of analytical methods should be completed within the next 6 months. Source of Na^{24} activity is well understood, and a start has been made in understanding the sources of turbidity. Hypothesis of nonselective corrosion is promising. Reactor operations at low power levels and purification flow rates other than 30 gpm provide opportunity for studying trends in analyses. 3 figs, 14 tabs. (DLC)

617 (DPSP–61-1841) **Effect of CO_2 pD control on area activity levels.** Tope, C.W. Du Pont de Nemours (E.I.) and Co.,

Aiken, SC (United States). 27 Jul 1961. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-76SR00001 ;AC09-89SR18035. (RTR–328). Order Number DE93000488. Source: OSTI; NTIS; GPO Dep.

Aluminum corrosion is a major cause of moderator turbidity and high radioactivity, which interfere with reactor operation and maintenance. The reduction and control of moderator pD was initiated with the P-8 cycle that began on June 25, 1959, in an effort to reduce aluminum corrosion and associated problems. Favorable results prompted the introduction of moderator pD control in all reactor areas. Radiation level measurements made during shutdowns prior to and subsequent to pD control in each area indicate that the program has been effective in reducing process system radiation levels. During the period June 25, 1959, to November 8, 1960, in P-Area the moderator pD was controlled by adding nitric acid to the moderator as required. Since November 8, 1960, the moderator pD in Area has been controlled by the addition of carbon dioxide to the blanket gas. An evaluation of the relative effectiveness of moderator pD control with nitric acid and with carbon dioxide in reducing process system radiation levels during shutdown is presented in this document.

618 (DPSP–61-2291) **Diffusion studies of uranium-aluminum materials: Mark VI-J fuel elements.** Philipp, R.F. Du Pont de Nemours (E.I.) and Co., Aiken, SC (United States). 14 Nov 1961. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-76SR00001 ;AC09-89SR18035. Order Number DE93000471. Source: OSTI; NTIS (US Sales Only); GPO Dep.

A visible change was snoted in the microstucture of Mark VI-J samples containing alloy core (U-Al) after heating at 500 C ($\geq$ 25 days) and 600 C ($\geq$ 2.8 days). Small particles were found along grain boundaries in a narrow zone in the cladding adjacent to the core. $\leq$ 123.8 ppM U^{235} was found in the outer 0.009 in. cladding heated at 500 C, 3.08 ppM at 300 C. In end defect samples containing both alloy core and AlSi, heating at $\geq$ 400 C caused the Si particles in the AlSi microstructure to disappear. Specimens with exposed alloy core were tested at $\leq$ 100 days in boiling deionized water at pH 5.5. No U was detected in solution after 10 days; after 100 days, the max U in solution was 1.6×10^{-3} for 1 $in.^2$ exposed core area. 2 tabs, 5 figs. (DLC)

619 (DPSP–64-2079) **Moderator chemistry.** Jacobsen, W.R. Du Pont de Nemours (E.I.) and Co., Aiken, SC (United States). 17 Dec 1964. 29p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. (RTR–708). Order Number DE92040820. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report provides the charts used by the writer in the Wilmington talk of November 6, 1964 on the subject of water chemistry. Two additional charts were prepared to answer questions which arose after the meeting and ate included. A brief description of each chart and the photostats are provided. Specific topics covered include: Nitric acid instability - Mark VI-B history, Direct addition of oxygen to moderator, C-7, C-9, K-11, Moderator Parameters L-2 vs K-11, Radioactivity - release to stream, Moderator fission product activity vs Maximum Oxide film thickness, Production mechanisms of higher actinides, Activities - Cm cycle, Alpha activity in C moderator, Alpha d/m/ml/ppm turbidity, Alpha program, L-area Problems, Removal of alumina from the reactor complex, and Comparison of fuel cycles. (GHH)

620 (DPSP–75-1219) **Mark 60B blanket tube failure.** Carlson, M.K. Du Pont de Nemours (E.I.) and Co., Aiken, SC (United States). Savannah River Plant. 1 Aug 1975. 32p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-76SR00001 ;AC09-89SR18035. Order Number DE93001355. Source: OSTI; NTIS; GPO Dep.

A Mark 60B Li-Al target element jammed during discharge from 105-K reactor on March 17, 1975. This failure is described. Fragments from it were analyzed to determine the most probable failure mechanism: The failed target element was single extruded. When a piece of Li-rich dross fell into the mold during casting, it remained intact until coextrusion, when it penetrated or greatly thinned the cladding. The inclusion reacted with moderator during irradiation to corrode the target element and cause swelling, which ultimately caused jamming. All targets should be double extruded. (DLC)

621 (DPW–5408) **Project 8980: Savannah River Plant, Building 105, reactor tank design.** Bellas, H.W. Du Pont de Nemours (E.I.) and Co., Wilmington, DE (United States). Explosives Dept. 19 May 1952. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-76SR00001. (SR/H–223). Order Number DE93001456. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The design of the tank structure of the Savannah River reactors has been under scrutiny from the standpoint of thermal stresses in the tank walls and joints. These stresses result from restraint of differential expansion of various wall sections that are in contact with different temperatures of liquids and varying amounts of radiation. For example, the bottom plate of the tank is heated from above by radiation effects and by effluent from fuel tubes and cooled from below by water in the bottom shield, while the side wall to which the bottom is welded may be washed by cool effluent from blanket tubes mixing with warm moderator. Since the resulting temperatures in the bottom plate and side wall can differ widely even in normal operation, the question has arisen as to what stresses are imposed on the weld and the plates adjoining. The major problems of interest are: (1) Bottom joint (between side wall and top to bottom shield). (a) Adequate design of joint - originally conceived as a right- angle double fillet weld. (b) Thermal stresses in and near joint - obtaining in normal operating conditions with various types of loading, and also transients in scrams, etc. (2) Top, expansion joint (between side wall and bearing ring of upper tank). (a) Thermal stresses in and near joint.

622 (DPW–5412) **Radiation from empty reactor.** Arnett, L.M. Du Pont de Nemours (E.I.) and Co., Wilmington, DE (United States). Explosives Dept. 15 May 1952. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-76SR00001. (SR/H–226). Order Number DE93001459. Source: OSTI; NTIS (US Sales Only); GPO Dep.

When one of the tubes through the bottom or top shield is opened and the inside of the empty reactor exposed, gamma radiation from three principal sources will escape. This report discusses the escape of radiation from and empty reactor.(JL)

623 (DPW–5475) **Trip report - Hanford, May 12–15, 1952.** Chren, W.A. Du Pont de Nemours (E.I.) and Co., Wilmington, DE (United States). Explosives Dept. 26 May 1952. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-76SR00001. (SR/H–231). Order Number DE93001905. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report summarizes a trip to the Hanford plant to obtain information concerning slug failures and related problems. The trip was on May 12–15, 1952. (JL)

624 (DPW–5490) **Trip report - Hanford Works.** Judkins, E.H. Du Pont de Nemours (E.I.) and Co., Wilmington, DE (United States). Explosives Dept. 27 May 1952. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-76SR00001. (SR/H–234). Order Number DE93001911. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This trip report discusses a visit to reacquaint the writer with Hanford equipment and practice. Also studied were slug rupture problems and contamination problems. The report is dated May 27, 1952. (JL)

625 (DPW–5601) **Corrosion testing program at Argonne National Laboratory.** Worthington, H. Du Pont de Nemours (E.I.) and Co., Wilmington, DE (United States). Explosives Dept. 6 Jun 1952. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-76SR00001. (SR/H–198). Order Number DE93000659. Source: OSTI; NTIS (US Sales Only); GPO Dep.

An outline is given of a corrosion testing program to find a uranium alloy with a corrosion resistance to water at 100 C about 1000 times as great as that of natural U. The material would be acceptable as a reactor fuel material (the cladding would be thinner than the present fuel slug). (DLC)

626 (DPW–5666) **Trip report: [Standard pile design].** Doeringsfeld, K.H. Du Pont de Nemours (E.I.) and Co., Wilmington, DE (United States). Explosives Dept. 4 Jun 1952. 9p. Sponsored

by USDOE, Washington, DC (United States). DOE Contract AC09-76SR00001. (SR/H–200). Order Number DE93000661. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This memorandum discusses a meeting held at the General Engineering Laboratories of General Electric on May 26, 1952, to discuss the status of the Standard Pile design. The memo is dated June 4, 1952.

627 (DPW–5715) **Trip report, Hanford, May 19–22, 1952: [Irrodiction results; uranium canning].** Dunnington, B.W. Du Pont de Nemours (E.I.) and Co., Wilmington, DE (United States). Explosives Dept. 26 Jun 1952. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-76SR00001. (SR/H–203). Order Number DE93000664. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Attempts to reduce the number of failures have resulted in the formulation of a number of plans for investigation, and a large increase in the technical staff assigned to work on reactor materials. This report discusses a visit to the Hanford Reservation in May, 1952 to review programs concerning the canning of uranium. (JL)

628 (HW–7-3486) **Production Test No. 305-9-P, poisoning effectiveness and uniformity of myrnalloy slugs.** Wende, C.W.J. Du Pont de Nemours (E.I.) and Co., Richland, WA (United States). 19 Feb 1946. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93001233. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The objective of this report is to determine the poisoning effectiveness and uniformity of a batch of approximately thirty myrnalloy slugs prior to charging into the B pile. The report is dated February 19, 1946. (JL)

629 (HW–11374) **History of the reactivation of 100-B pile.** Filip, E.J. Hanford Works, Richland, WA (United States). 29 Oct 1948. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93000330. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report summarizes the preparations made for reactivation of the 100-B pile and the operational activities associated with the reactivation and subsequent operation up to the time of reaching desired power level. The period covered is from approximately June 1, 1948 until July 16, 1948.

630 (HW–20250) **New reactor area.** Gross, C.N. Hanford Works, Richland, WA (United States). 29 Jan 1951. 2p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93002065. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This memorandum discusses discusses the design of a new reactor area in relation to the H pile.

631 (HW–21761) **Report on additional production capacity of Hanford Works meeting to fix water requirements.** Gast, P.F. Hanford Works, Richland, WA (United States). 26 Jul 1951. 2p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93002070. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This memorandum discusses a meeting held to fix water requirements necessary for additional production capacity.

632 (HW–22109) **Report on additional production capacity of Hanford Works expected life of piles.** McClaine, L.A.; Bupp, L.P. Hanford Works, Richland, WA (United States). 8 Aug 1951. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93002071. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This memorandum discusses the expected life of the piles with regard to additional production capacity.

633 (HW–22110) **Report on additional production capacity of Hanford Works – Factors Involved In Case II and Case III.** Reinker, P.H. Hanford Works, Richland, WA (United States). 8 Aug 1951. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93002073. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This memorandum discusses factors involved in the additional production capacity of Hanford Works.

634 (HW–22423) **Development of new methods for removing ruptured slugs.** Warren, J.H. Hanford Works, Richland, WA (United States). 12 Oct 1951. 1p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93002072. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This memorandum discusses the removal of ruptured slugs utilizing new methodology.

635 (HW–28778) **A program for testing raw Columbia River water as a pile coolant.** Atwood, J.M. Hanford Works, Richland, WA (United States). 21 Jul 1953. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93000331. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The potentialities of unfiltered Columbia River water as a pile coolant have been discussed in a recent survey of the available information on the subject. The survey report points out the gains which the use of unfiltered water offers, and proposes a logical framework of treatment by chemical additives which appears to have a reasonable probability of successfully developing a far less expensive pile coolant. A comprehensive testing program is now being initiated to obtain the required experimental information concerning the effects of unfiltered water on corrosion, film formation, and effluent activity. The purpose of this report is to outline the range of variables to be studied; to discuss the various experimental techniques to be used; and to establish the anticipated scheduling of the several phases of the program.

636 (HW–29406) **The effects of water quality on pile operation: Production test number 105-525-E.** Miller, N.R. General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 21 Sep 1953. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93000332. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The objective of this test is to evaluate the effects of low pH process water and unfiltered river water on pile operation. This report is dated September 21, 1953.

637 (HW–43938-Del.) **Hanford Atomic Products Operation monthly report, June 1956.** General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 23 Jul 1956. 405p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93000764. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This document presents a summary of work and progress at the Hanford Engineer Works for June 1956. The report is divided into sections by department. A plant wide general summary is included at the beginning of the report, after which the departmental summaries begin. The Manufacturing Department reports plant statistics, and summaries for the Metal Preparation, Reactor and Separation sections. The Engineering Department's section summarizes work for the Technical, Design, and Project Sections. Costs for the various departments are presented in the Financial Department's summary. The Medical, Radiological Sciences, Utilities and General Services, Employee and Public Relations, and Community Real Estate and Services departments have sections presenting their monthly statistics, work, progress, and summaries.

638 (HW–51741-Del.) **Hanford Laboratories Operation monthly activities report, July 1957.** Parker, H.M. General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 15 Aug 1957. 133p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93001330. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This document presents a summary of work and progress at the Hanford Engineer Works for July, 1957. The report is divided into sections by department. A plant wide general summary is included at the beginning of the report, after which the departmental summaries begin. The manufacturing Department reports plant statistics, and summaries for the Metal Preparation, Reactor and separation sections. The Engineering Department's section summarizes work for the Technical, Design, and Project sections. Costs for the various departments are presented in the Financial Department's summary. The Medical, Radiological Sciences, Utilities and

General Services, Employee and Public Relations, and Community Real Estate and Services Departments have sections presenting their monthly statistics, work, progress, and summaries.

639 (HW–52809-Del.) **Irradiation Processing Department monthly record report, September 1957.** General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 21 Oct 1957. 143p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE92040140. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report details activities of the irradiation department during the month of September, 1957. The report is divided into the following sections: Research and Engineering operations; Production and Reactor Operations; Facilities Engineering Operations; Employee Relations Operations; and Financial Operation.

640 (HW–54689-Del.) **Irradiation Processing Department, monthly record report, January 1958.** Greninger, A.B. General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 21 Feb 1958. 145p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93000999. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This document details activities of the irradiation processing department during the month of January, 1958. A general summary is included at the start of the report, after which the report is divided into the following sections: Research and Engineering Operations; Production and Reactor Operations; Facilities Engineering Operation; Employee Relations Operation; and Financial Operation.

641 (HW–54760-Del.) **Hanford Laboratories Operation, monthly activities report, January 1958.** Parker, H.M. General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 15 Feb 1958. 164p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93000767. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This document presents a summary of work and progress at the Hanford Engineer Works for January, 1958. The report is divided into sections by department. A plant wide general summary is included at the beginning of the report, after which the departmental summaries begin. The manufacturing Department reports plant statistics, and summaries for the Metal Preparation, Reactor and separation sections. The Engineering Department's section summarizes work for the Technical, Design, and Project sections. Costs for the various departments are presented in the Financial Department's summary. The Medical, Radiological Sciences, Utilities and General Services, Employee and Public Relations, and Community Real Estate and Services Departments have sections presenting their monthly statistics, work, progress, and summaries.

642 (HW–55462) **Irradiation Processing Department monthly record report, March 1958.** Greninger, A.B. Hanford Works, Richland, WA (United States). 21 Apr 1958. 145p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93001249. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This document details activities of the irradiation processing department during the month of March, 1958. A general summary is included at the start of the report, after which the report is divided into the following sections: Research and Engineering Operations; Production and Reactor Operations; Facilities Engineering Operation; Employee Relations Operation; and Financial Operation.

643 (HW–55870-Del.) **Irradiation Processing Department, monthly record report, April 1958.** Greninger, A.B. Hanford Works, Richland, WA (United States). 21 May 1958. 151p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93001000. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This document details activities of the irradiation processing department during the month of April, 1958. A general summary is included at the start of the report, after which the report is divided into the following sections: Research and Engineering Operations; Production and Reactor Operations; Facilities Engineering Operation; Employee Relations Operation; and Financial Operation.

644 (HW–59840-Del.) **Irradiation Processing Department monthly record report, March 1959.** Greninger, A.B. Hanford Works, Richland, WA (United States). 21 Apr 1959. 142p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93001250. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This document details activities of the irradiation processing department during the month of March, 1959. A general summary is included at the start of the report, after which the report is divided into the following sections: Research and Engineering Operations; Production and Reactor Operations; Facilities Engineering Operation; Employee Relations Operation; and Financial Operation.

645 (HW–60246) **Irradiation Processing Department monthly record report, April 1959.** General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 21 May 1959. 137p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93001251. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This document details activities of the irradiation processing department during the month of April, 1959. A general summary is included at the start of the report, after which the report is divided into the following sections: Research and engineering operations; production and reactor operations; facilities engineering operation; employee relations operation; and financial operation.

646 (HW–60327-Del.) **Fuels Preparation Department monthly report for April, 1959.** Hanford Works, Richland, WA (United States). 25 May 1959. 45p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93000990. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This document details activities of the Fuels Preparation Department during the month of April 1959. (FI)

647 (HW–62184) **Irradiation Processing Department monthly record report, September 1959.** Greninger, A.B. General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 22 Oct 1959. 123p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93001318. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This document details activities of the irradiation processing department during the month of September, 1959. A general summary is included at the start of the report, after which the report is divided into the following sections: Research and Engineering Operations; Production and Reactor Operations; Facilities Engineering Operation; Employee Relations Operation; and Financial Operation.

648 (HW–62599) **Irradiation Processing Department monthly record report, October 1959.** General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 20 Nov 1959. 124p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93001739. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This document details activities of the irradiation processing department during the month of October, 1959. A general summary is included at the start of the report, after which the report is divided into the following sections: Research and Engineering Operations; Production and Reactor operations; Facilities Engineering operation; Employee Relations Operation; and Financial operation.

649 (HW–63317-Del.) **Irradiation Processing Department monthly record report, December 1959.** Greninger, A.B. General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 22 Jan 1960. 119p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93001319. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This document details activities of the irradiation processing department during the month of December, 1959. A general summary is included at the start of the report, after which the report is divided into the following sections: Research and Engineering Operations; Production and Reactor Operations; Facilities Engineering Operation; Employee Relations Operation; and Financial Operation.

650 (HW–63740) **Hanford Laboratories Operation monthly activities report, January 1960.** General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 15 Feb 1960. 157p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93000770. Source: OSTI; NTIS (US Sales Only); GPO Dep.

R and D is reported in the following: Reactor and Fuels (PRTR, Pu fabrication pilot plant, KER, NPR, materials); Chemical R and D (Pm recovery, fission products, Purex column, non-production fuels reprocessing, Salt Cycle process); Physics and Instrument R and D (PCTR, NPR, critical experiments, PRTR); and Biology (monitoring, irradiation experiments).

651 (HW–66237) **Hanford Laboratories Operation monthly activities report, July 1960.** Bennett, C.A. General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 15 Aug 1960. 160p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93001334. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This document presents a summary of work and progress at the Hanford Engineer Works for July, 1969. The report is divided into sections by department. A plant wide general summary is included at the beginning of the report, after which the departmental summaries begin. The manufacturing Department reports plant statistics, and summaries for the Metal Preparation, Reactor and separation sections. The Engineering Department's section summarizes work for the Technical, Design, and Project sections. Costs for the various departments are presented in the Financial Department's summary. The Medical, Radiological Sciences, Utilities and General Services, Employee and Public Relations, and Community Real Estate and Services Departments have sections presenting their monthly statistics, work, progress, and summaries.

652 (HW–66970) **Irradiation Processing Department monthly report, September 1960.** General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 12 Oct 1960. 85p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93001252. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This document details activities of the irradiation processing department during the month of September, 1960. A general summary is included at the start of the report, after which the report is divided into the following sections: research and engineering operations; production and reactor operations; facilities engineering operation; employee relations operation; and financial operation.

653 (HW–67699) **Fuels Preparation Department monthly report, November 1960.** Dickeman, R. L. General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 7 Dec 1960. 46p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93000992. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This document details activities of the Fuels Preparation Department during the month of November 1960. (FI)

654 (HW–68029) **Fuels Preparation Department monthly report, December 1960.** General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 10 Jan 1961. 43p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93000993. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This document details activities of the Fuels Preparation Department during the month of December 1960.

655 (HW–68320) **Fuels Preparation Department monthly summary report, January 1961.** Dickeman, R.L. General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 7 Feb 1961. 51p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93000994. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This document details activities of the Fuels Preparation Department during the month of January 1961. (FI)

656 (HW–68696) **Fuels Preparation Department monthly report, February 1961.** Dickeman, R.L. General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 7 Mar 1961. 55p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93000995. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This document details activities of the Fuels Preparation Department during the month of February 1961. (FI)

657 (HW–69054) **Fuels Preparation Department monthly report, March 1961.** General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 7 Apr 1961. 53p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93000334. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This document details activities of the Fuels Preparation Department during the month of March 1961. (FI)

658 (HW–69441) **Fuels Preparation Department monthly report, April 1961.** General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 7 May 1961. 50p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93000335. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This document details activities of the Fuels Preparation Department during the month of April 1961. (FI)

659 (HW–70606) **Fuels Preparation Department monthly report, July 1961.** General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 7 Aug 1961. 52p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93000963. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This document details activities of the Fuels Preparation Department during the month of July 1961. (FI)

660 (HW–70920) **Fuels Preparation Department monthly report, August 1961.** Dickeman, R.L. General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 7 Sep 1961. 56p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93000996. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report is divided into: production (fuel elements), engineering (present reactor fuels, N Reactor development), and general (AlSi shop). (DLC)

661 (HW–71216) **Fuels Preparation Department monthly report, September 1961.** General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 7 Oct 1961. 53p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93000336. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This document details activities of the Fuels Preparation Department during the month of September, 1961. (FI)

662 (HW–71571) **Fuels Preparation Department monthly report, October 1961.** General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 7 Nov 1961. 58p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93000337. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This document details activities of the Fuels Preparation Department during the month of October 1961. (FI)

663 (HW–71897) **Fuels preparation department, monthly report, November 1961.** Dickeman, R.L. General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 7 Dec 1961. 51p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93000997. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This document details activities of the Fuels Preparation Department during the month of November 1961.

664 (HW–72857) **Fuels Preparation Department monthly report, February 1962.** General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 7 Mar 1962. 53p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93000338. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This document details activities of the Fuels Preparation Department during the month of February 1962.

665 (HW–73205) **Fuels Preparation Department monthly report, March 1962.** Dickeman, R.L. General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 9 Apr 1962. 52p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93000982. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This document details activities of the Fuels Preparation Department during the month of March 1962. (FI)

666 (HW–73514) **Hanford Laboratories Operation monthly activities report, April 1962.** Reas, W.H. General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 15 May 1962. 219p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93001230. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This document presents a summary of work and progress at the Hanford Engineer Works for April, 1962. The report is divided into sections by department. A plant wide general summary is included at the beginning of the report, after which the departmental summaries begin. The manufacturing Department reports plant statistics, and summaries for the Metal Preparation, Reactor and separation sections. The Engineering Department's section summarizes work for the Technical, Design, and Project sections. Costs for the various departments are presented in the Financial Department's summary. The Medical, Radiological Sciences, Utilities and General Services, Employee and Public Relations, and Community Real Estate and Services Departments have sections presenting their monthly statistics, work, progress, and summaries.

667 (HW–73532) **Fuels Preparation Department monthly report, April 1962.** Dickeman, R.L. General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 7 May 1962. 56p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93000984. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This document details activities of the Fuels Preparation Department during the month of April 1962. (FI)

668 (HW–73908) **Fuels Preparation Department monthly report, May 1962.** General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 7 Jun 1962. 59p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93000985. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This document details activities of the Fuels Preparation Department during the month of May 1962.

669 (HW–74175) **Fuels Preparation Department monthly report, June 1962.** General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 9 Jul 1962. 53p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93000986. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This document details activities of the Fuels Preparation Department during the month of June 1962.

670 (HW–74506) **Fuels Preparation Department monthly report, July 1962.** General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 7 Aug 1962. 51p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93000987. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This document details activities of the Fuels Preparation Department during the month of July 1962.

671 (HW–74794) **Fuels Preparation Department monthly report, August 1962.** Dickeman, R.L. General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 7 Sep 1962. 61p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93000988. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report is divided into manufacturing (AlSi process, coextrusion) and engineering (present reactor fuels, new canning processes, N Reactor fuels).

672 (HW–75099) **Fuels Preparation Department monthly report, September 1962.** Dickeman, R.L. General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 8 Oct 1962. 53p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93000989. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This document details activities of the Fuels Preparation Department during the month of September 1962. (FI)

673 (HW–75683) **Fuels Preparation Department monthly report, November 1962.** General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 7 Dec 1962. 71p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93000876. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This document details activities of the Fuels Preparation Department during the month of November 1962.

674 (IGC–124) **Analysis of selected fast critical assemblies using JENDL-2 based unadjusted multigroup data.** Devan, K.; Gopalkrishnan, V.; Ramanadhan, M.M.; Lee, S.M. Indira Gandhi Centre for Atomic Research, Kalpakkam (India). 1991. 41p. Order Number DE93605831. Source: OSTI; NTIS (US Sales Only); INIS.

In order to validate the non-adjusted multigroup cross section set recently prepared from the Japanese Evaluated Nuclear Data Library - Version 2 (JENDL-2), some of the integral parameters of several fast critical benchmark reactor assemblies were analysed by comparing the measured values with those predictions using this cross section set and also by intercomparing the values predicted by various cross section sets. The observations of analyses are presented in this report. The benchmark assemblies have been chosen such that there is a variety in core size, majorfuel component, reflector used etc. One dimensional homogeneous diffusion theory model was used and suitable corrections were added. The assemblies considered were among the ones recommended by the Cross Section Evaluation Working Group (CSEWG), viz. ZPR-3-12, ZPR-3-48, ZPR-3-49, ZPR-3-50, ZPR-3-53, ZPR-3-54, ZPR-3-56B, ZPR-6-7 and ZPR-6-6A. (author). 10 refs., 25 tabs.

675 (INIS-BR–2942, pp. 6-7) **Experiments to increase the thermal neutron flux in the R.P.R. reactor central channel.** Assis, J.T. de (Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Div. de Fisica de Reatores); Batista, J.L.; Santos Bastos, W. dos; Brito Aghina, L.O de. Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1989. 147p. (In Portuguese). In *Triennial technical report - 1986, 1987, 1988 - Instituto de Engenharia Nuclear (IEN) -Dept. of Reactors (DERE).* Order Number DE93605069. Source: OSTI; NTIS (US Sales Only); INIS.

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Published in summary form only. ISOTOPE PRODUCTION REACTORS/neutron flux; ISOTOPE PRODUCTION REACTORS/reactor channels; BERYLLIUM; FUEL ELEMENTS; GRAPHITE; OPTIMIZATION; PLANNING; SPACERS; THERMAL NEUTRONS

676 (INIS-BR–2942, pp. 8) **Preliminary report about the R.P.R. reactor without central chamber.** Assis, J.T. de (Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Div. de Fisica de Reatores); Reis Filho, P.E.G. dos; Moreira, F.J.; Santos Bastos, W. dos; Brito Aghina, L.O. de. Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1989. 147p. (In Portuguese). In *Triennial technical report - 1986, 1987, 1988 - Instituto de Engenharia Nuclear (IEN) -Dept. of Reactors (DERE).* Order Number DE93605069. Source: OSTI; NTIS (US Sales Only); INIS.

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Published in summary form only. ISOTOPE PRODUCTION REACTORS/reactor channels; CONTROL ELEMENTS; MOLYBDENUM 99; NEUTRON FLUX; TECHNETIUM 99; THERMODYNAMICS; URANIUM DIOXIDE

677 (INIS-BR–2942, pp. 11) **R.P.R. burnup calculation: first phase.** Assis, J.T. de (Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Div. de Fisica de Reatores). Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1989. 147p. (In Portuguese). In *Triennial technical report - 1986, 1987, 1988 - Instituto de Engenharia Nuclear (IEN) -Dept.*

of Reactors (DERE). Order Number DE93605069. Source: OSTI; NTIS (US Sales Only); INIS.

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Published in summary form only. ISOTOPE PRODUCTION REACTORS/burnup; BUCKLING; FUEL ELEMENTS; BURNUP; REACTIVITY

678 (INIS-BR–2942, pp. 13-14) **Measurement results of Argonauta reactor conversion factor.** Souza, M.I.S. (Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Div. de Fisica de Reatores). Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1989. 147p. (In Portuguese). In *Triennial technical report - 1986, 1987, 1988 - Instituto de Engenharia Nuclear (IEN) -Dept. of Reactors (DERE).* Order Number DE93605069. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. RIEN-1 REACTOR/thermal neutrons; ELECTRODEPOSITION; MEV RANGE 10-100; THIN FILMS; URANIUM

679 (INIS-BR–2942, pp. 14) **Operation and maintenance of the Argonauta reactor.** Franca, L.A.B. (Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Div. de Fisica de Reatores). Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1989. 147p. (In Portuguese). In *Triennial technical report - 1986, 1987, 1988 - Instituto de Engenharia Nuclear (IEN) -Dept. of Reactors (DERE).* Order Number DE93605069. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. RIEN-1 REACTOR/reactor maintenance; RIEN-1 REACTOR/reactor operation; CONTAINMENT BUILDINGS; EDUCATION; IRRADIATION; REACTOR CONTROL SYSTEMS; REACTOR INSTRUMENTATION; SHIELDS

680 (INIS-BR–2942, pp. 16) **Neutronic study of 5 MW R.P.R. reactor without central chamber.** Assis, J.T. (Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Div. de Fisica de Reatores); Moreira, F.J.; Santos Bastos, W. dos; Brito Aghina, L.O. de. Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1989. 147p. (In Portuguese). In *Triennial technical report - 1986, 1987, 1988 - Instituto de Engenharia Nuclear (IEN) -Dept. of Reactors (DERE).* Order Number DE93605069. Source: OSTI; NTIS (US Sales Only); INIS.

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681 (INIS-BR–2942, pp. 19) **Shielding calculation for fission products radiation levels in the R.P.R. reactor after the shutdown.** Renke, C.A.C. (Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Div. de Fisica de Reatores). Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1989. 147p. (In Portuguese). In *Triennial technical report - 1986, 1987, 1988 - Instituto de Engenharia Nuclear (IEN) -Dept. of Reactors (DERE).* Order Number DE93605069. Source: OSTI; NTIS (US Sales Only); INIS.

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Published in summary form only. ISOTOPE PRODUCTION REACTORS/fission products; ISOTOPE PRODUCTION REACTORS/s codes; BURNUP; GAMMA RADIATION; RADIATION DOSES; REACTOR SHUTDOWN; SHIELDING

682 (INIS-BR–2942, pp. 20) **Reliability study on calculation methods applied to the R.P.R. reactor.** Moreira, F.J. (Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Div. de Fisica de Reatores); Assis, J.T. de. Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1989. 147p. (In Portuguese). In *Triennial technical report - 1986, 1987, 1988 - Instituto de Engenharia Nuclear (IEN) -Dept. of Reactors (DERE).* Order Number DE93605069. Source: OSTI; NTIS (US Sales Only); INIS.

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Published in summary form only. ISOTOPE PRODUCTION REACTORS/neutron spectra; ISOTOPE PRODUCTION REACTORS/reactor cells; COMPARATIVE EVALUATIONS; CRITICALITY; H CODES; L CODES; NEUTRON FLUX; RELIABILITY

683 (INIS-BR–2942, pp. 22) **Optimization study of the R.P.R. reactor with 4.3% enriched fuel.** Renke, C.A.C. (Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Div. de Fisica de Reatores); Couto, R.T. Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1989. 147p. (In Portuguese). In *Triennial technical report - 1986, 1987, 1988 - Instituto de Engenharia Nuclear (IEN) -Dept. of Reactors (DERE).* Order Number DE93605069. Source: OSTI; NTIS (US Sales Only); INIS.

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Published in summary form only. ISOTOPE PRODUCTION REACTORS/reactor fueling; BURNUP; ENRICHED URANIUM; GRAPHITE; NEUTRON FLUX; OPTIMIZATION; URANIUM 235

684 (INIS-BR–2942, pp. 24) **Reactor kinetics modulus.** Santos, R.S. dos (Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Div. de Fisica de Reatores). Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1989. 147p. (In Portuguese). In *Triennial technical report - 1986, 1987, 1988 - Instituto de Engenharia Nuclear (IEN) -Dept. of Reactors (DERE).* Order Number DE93605069. Source: OSTI; NTIS (US Sales Only); INIS.

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685 (INIS-BR–2942, pp. 30) **Development planning of a subcritical assembly in the Argonauta reactor.** Voi, D.L. (Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Div. de Fisica de Reatores); Brito Aghina, L.O. de; Santos Bastos, W. dos. Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1989. 147p. (In Portuguese). In *Triennial technical report - 1986, 1987, 1988 - Instituto de Engenharia Nuclear (IEN) -Dept. of Reactors (DERE).* Order Number DE93605069. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. RIEN-1 REACTOR/subcritical assemblies; SUBCRITICAL ASSEMBLIES/experiment planning; MODIFICATIONS; NATURAL URANIUM; NEUTRON FLUX

686 (INIS-BR–2942, pp. 34-35) **Preliminary investigation about the structural materials effects on reactivity and irradiation chamber thermal flux of the 5 MW, 4,3% enriched uranium R.P.R. reactor.** Couto, R.T. (Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Div. de Fisica de Reatores); Renke, C.A.C.; Brito Aghina, L.O. de. Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1989. 147p. (In Portuguese). In *Triennial technical report - 1986, 1987, 1988 - Instituto de Engenharia Nuclear (IEN) -Dept. of Reactors (DERE).* Order Number DE93605069. Source: OSTI; NTIS (US Sales Only); INIS.

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Published in summary form only. ISOTOPE PRODUCTION REACTORS/building materials; ISOTOPE PRODUCTION REACTORS/neutron flux; ISOTOPE PRODUCTION REACTORS/reactivity; CONTROL ELEMENTS; FISSION PRODUCTS; REACTIVITY; MOLYBDENUM OXIDES; THERMODYNAMICS; URANIUM DIOXIDE; WATER; ZIRCALOY

687 (INIS-BR–2942, pp. 39) **Neutronic study on influence of 8 plates of the Argonauta reactor fuel element with cermet height reduced from 60,20 cm to 52,51 cm.** Renke, C.A.C. (Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Div. de Fisica de Reatores); Brito Aghina, L.O. de. Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1989. 147p. (In Portuguese). In *Triennial technical report - 1986, 1987, 1988 - Instituto de Engenharia Nuclear (IEN) -Dept. of Reactors (DERE).* Order Number DE93605069. Source: OSTI; NTIS (US Sales Only); INIS.

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Published in summary form only. RIEN-1 REACTOR/fuel elements; C CODES; CERMETS; H CODES; HEIGHT; MODIFICATIONS

688 (INIS-BR–2942, pp. 46) **Study on techniques and methods for determination of reactor parameters in a subcritical unit.** Voi, D.L. (Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Div. de Fisica de Reatores); Brito Aghina, L.O. de; Santos Bastos, W. dos. Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1989. 147p. (In Portuguese). In *Triennial technical report - 1986, 1987, 1988 - Instituto de Engenharia Nuclear (IEN) -Dept. of Reactors (DERE).* Order Number DE93605069. Source: OSTI; NTIS (US Sales Only); INIS.

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689 (INIS-BR–2942, pp. 58-59) **Test section for the determination of loss of pressure in the radioisotope production reactor fuel elements.** Bloch, M. (Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores); Morgado, A. Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1989. 147p. (In Portuguese). In *Triennial technical report - 1986, 1987, 1988 - Instituto de Engenharia Nuclear (IEN) -Dept. of Reactors (DERE).* Order Number DE93605069. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. ISOTOPE PRODUCTION REACTORS/pressure drop; COMPUTER CALCULATIONS; COOLANT LOOPS; COOLING; FLOW RATE; FUEL ELEMENTS; PLANNING

690 (INIS-BR–2942, pp. 106-107) **Calculations of thermohydraulic limits of a plate type reactors in conditions of normal cooling and natural convection.** Botelho, D.A. (Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Div. de Termohidraulica de Reatores); Garro, O.O.A. Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1989. 147p. (In Portuguese). In *Triennial technical report - 1986, 1987, 1988 - Instituto de Engenharia Nuclear (IEN) -Dept. of Reactors (DERE).* Order Number DE93605069. Source: OSTI; NTIS (US Sales Only); INIS.

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691 (INIS-BR–2942, pp. 107-108) **Heat dynamic in the primary circuit of the R.P.R. reactor.** Gebrim, A.N. (Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Div. de Termohidraulica de Reatores). Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1989. 147p. (In Portuguese). In *Triennial technical report - 1986, 1987, 1988 - Instituto de Engenharia Nuclear (IEN) -Dept. of Reactors (DERE).* Order Number DE93605069. Source: OSTI; NTIS (US Sales Only); INIS.

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692 (INIS-BR–2942, pp. 108-109) **Simplified analysis for transients in pool type liquid metal reactors.** Botelho, D.A. (Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Div. de Termohidraulica de Reatores). Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1989. 147p. (In Portuguese). In *Triennial technical report - 1986, 1987, 1988 - Instituto de Engenharia Nuclear (IEN) -Dept. of Reactors (DERE).* Order Number DE93605069. Source: OSTI; NTIS (US Sales Only); INIS.

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693 (INIS-BR–2942, pp. 111-112) **Definition of height and dimensions of stack of R.P.R. reactor building.** Gebrim, A.N. (Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Div. de Termohidraulica de Reatores). Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1989. 147p. (In Portuguese). In *Triennial technical report - 1986, 1987, 1988 - Instituto de Engenharia Nuclear (IEN) -Dept. of Reactors (DERE).* Order Number DE93605069. Source: OSTI; NTIS (US Sales Only); INIS.

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694 (INIS-BR–2942, pp. 113-114) **Analytical model and complementary experiences for natural convection in the R.P.R. reactor.** Sampaio, P.A.B. (Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Div. de Termohidraulica de Reatores). Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1989. 147p. (In Portuguese). In *Triennial technical report - 1986, 1987, 1988 - Instituto de Engenharia Nuclear (IEN) -Dept. of Reactors (DERE).* Order Number DE93605069. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. ISOTOPE PRODUCTION REACTORS/natural convection; FUEL RODS; MATHEMATICAL MODELS; PRESSURE DROP; REACTOR SHUTDOWN

695 (INIS-BR–2942, pp. 115-116) **Manual of SITIO computer code for calculation of local radiological dose.** Gebrim, A.N. (Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Div. de Termohidraulica de Reatores). Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1989. 147p. (In Portuguese). In *Triennial technical report - 1986, 1987, 1988 - Instituto de Engenharia Nuclear (IEN) -Dept. of Reactors (DERE).* Order Number DE93605069. Source: OSTI; NTIS (US Sales Only); INIS.

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696 (INIS-BR–2942, pp. 116-117) **Manual of the computer program NUC2 for the thermohydraulic calculation of the research reactor primary coolant circuit.** Gebrim, A.N. (Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Div. de Termohidraulica de Reatores). Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1989. 147p. (In Portuguese). In *Triennial technical report - 1986, 1987, 1988 - Instituto de Engenharia Nuclear (IEN) -Dept. of Reactors (DERE).* Order Number DE93605069. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. RESEARCH REACTORS/primary coolant circuits; RESEARCH REACTORS/thermodynamics; HEAT EXCHANGERS; HYDRAULICS; N CODES; NATURAL CONVECTION; THERMODYNAMICS; TRANSIENTS

697 (INIS-BR–2942, pp. 117-118) **Heat removal by natural convection in a R.P.R. reactor.** Sampaio, P.A.B. de (Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Div. de Termohidraulica de Reatores). Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1989. 147p. (In Portuguese). In *Triennial technical report - 1986, 1987, 1988 - Instituto de Engenharia Nuclear (IEN) -Dept. of Reactors (DERE).* Order Number DE93605069. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. ISOTOPE PRODUCTION REACTORS/natural convection; C CODES; FINITE ELEMENT METHOD; FUEL ELEMENTS; HYDRAULICS; LOSS OF FLOW; REACTOR SHUTDOWN; THERMODYNAMICS; TWO-DIMENSIONAL CALCULATIONS

698 (INIS-BR–2942, pp. 119) **Utilization manual of the computer code 3D-AIRLOCA.** Sato, E.F. (Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Div. de Termohidraulica de Reatores). Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1989. 147p. (In Portuguese). In *Triennial technical report - 1986, 1987, 1988 - Instituto de Engenharia Nuclear (IEN) -Dept. of Reactors (DERE).* Order Number DE93605069. Source: OSTI; NTIS (US Sales Only); INIS.

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699 (INIS-BR–2942, pp. 124) **Preparation of EBR-II reactor data for the SORES code. Part II: steady state.** Moreira, M.L. (Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Div. de Termohidraulica de Reatores); Sato, E.F. Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1989. 147p. (In Portuguese). In *Triennial technical report - 1986, 1987, 1988 - Instituto de Engenharia Nuclear (IEN) -Dept. of Reactors (DERE).* Order Number DE93605069. Source: OSTI; NTIS (US Sales Only); INIS.

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700 (INIS-BR–2942, pp. 125) **Experimental results of drop of pressure and friction factor of preliminary tests in R.P.R. reactor fuel elements.** Faccini, J.L.H. (Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Div. de Termohidraulica de Reatores); Silva, P.F.V. da. Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1989. 147p. (In Portuguese). In *Triennial technical report - 1986, 1987, 1988 - Instituto de Engenharia Nuclear (IEN) -Dept. of Reactors (DERE).* Order Number DE93605069. Source: OSTI; NTIS (US Sales Only); INIS.

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701 (INIS-BR–2942, pp. 122-123) **Boundary conditions for natural convection analysis in the R.P.R. reactor pool.** Sampaio, P.A.B. de (Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Div. de Termohidraulica de Reatores). Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1989. 147p. (In Portuguese). In *Triennial technical report - 1986, 1987, 1988 - Instituto de Engenharia Nuclear (IEN) -Dept. of Reactors (DERE).* Order Number DE93605069. Source: OSTI; NTIS (US Sales Only); INIS.

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702 (JINR-E–13-90-233) **Pattern recognition application for surveillance of abnormal conditions in a nuclear reactor.** Pepelyshev, Yu.N.; Dzwinel, W. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Neutron Physics. 1990. 11p. Order Number DE93605832. Source: OSTI; NTIS (US Sales Only); INIS.

Submitted to Ann. Nucl. Energy.

The system to monitor abnormal conditions in a nuclear reactor, based on the noise analysis of the reactor basic parameters such as power, temperature and coolant flow rate, has been developed. The pattern recognition techniques such as clustering, cluster analysis, feature selection and clusters visualization methods form the basis of the software. Apart from non-hierarchical clustering procedures applied earlier, the hierarchical one is recommended. The system application for IBR-2 Dubna reactor diagnostics is shown. 10 refs.; 6 figs.

703 (KAERI/RR–1017/90) **The development of silicon doping technique by neutron transmutation.** Kim, Huhn Jun (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Kim, Yong Che; Chun, Byung Chil; Lee, Chang Hee; Lee, Jeong Soo; Seong, Baek Seok; Shim, Hae Seop; Choi, Byoung Hoon; Ho, Jong Wha. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Aug 1991. 113p. (In Korean). Order Number DE93605833. Source: OSTI; NTIS (US Sales Only); INIS.

This project is the 3rd year research which develops the neutron transmutation doping techniques for the large diameter Si ingot (max. 150mm, target resistivity ±5%) at the KMRR irradiation sleeve sites. Contents of this year research are design of the irradiation sleeve design and making of irradiation facility, and measurements of absolute neutron flux distribution. 1D-ANISN result, which was developed for design of irradiation sleeve on the fixed position method, was revised by 2D-VENTURE code calculation, and variations of flux distribution due to Si ingot insertion and effects of Al filler addition were studied. Study is in progress for optimized screen design according to the flux variation during the KMRR fuel cycle and evaluation of its uniformity. First prototype of semi-automatic irradiation facility was designed and fabricated, and is under test. Overall precision satisfies design goals, and improvements are under way for emergency state and their safety operations. Precise fast neutron measurements and its integrated spectrum were developed, and design of foil detector kits and working manual for the measurement are being prepared. (Author).

704 (WSRC-RP–91-0952) **Scoping tests on the potential for lithium/aluminum steam explosions in an SRS Septifoil: Severe Accident Program.** Cho, D.H. (Argonne National Lab., IL (United States)); Gabor, J.D.; Purviance, R.T.; Cassulo, J.C.; Ellison, P.G.; Hyder, M.L. Westinghouse Savannah River Co., Aiken, SC (United States); Argonne National Lab., IL (United States). Sep 1991. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE92040819. Source: OSTI; NTIS; GPO Dep.

In May 1991, WSRC/SRL requested that ANL conduct five scoping tests in order to investigate the potential for self-triggered lithium/aluminum steam explosion in an SRS Septifoil. This work was to support the ongoing SAR Chapter 15 analysis for the K-reactor restart at SRS. The five tests were successfully completed over a two-month period between June and August 1991. The conditions for the five tests were specified by the WSRC designated technical manager, Dr. Phillip G. Ellison. While the tests were carried out in an existing facility at ANL, WSRC/SRL provided the test sections which consisted of a three-foot long SRS Septifoil section including webbing, bottom endfitting, and eleven-inch long control rod segments. In addition, WSRC/SRL supplied the lithium/aluminum alloy required for the tests.

2209 Reactor Safety

Refer also to citation(s) 304, 305, 441, 583, 584, 593, 617, 634, 2446

705 (ANL/CP–76320) **Experimental and design experience with passive safety features of liquid metal reactors.** Lucoff, D.M. (Westinghouse Hanford Co., Richland, WA (United States)); Waltar, A.E.; Sackett, J.I.; Salvatores, M.; Aizawa, K. Argonne National Lab., Idaho Falls, ID (United States). Oct 1992. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-921003–9: International conference on design and safety of advanced nuclear power plants, Tokyo (Japan), 25-28 Oct 1992). Order Number DE92041097. Source: OSTI; NTIS; INIS; GPO Dep.

Liquid metal cooled reactors (LMRs) have already been demonstrated to be robust machines. Many reactor designers now believe that it is possible to include in this technology sufficient passive safety that LMRs would be able to survive loss of flow, loss of heat sink, and transient overpower events, even if the plant protective system fails completely and do so without damage to the core. Early whole-core testing in Rapsodie, EBR-II. and FFTF indicate such designs may be possible. The operational safety testing program in EBR-II is demonstrating benign response of the reactor to a full range of controls failures. But additional testing is needed if transient core structural response under major accident conditions is to be properly understood. The proposed international Phase IIB passive safety tests in FFTF, being designed with a particular emphasis on providing, data to understand core bowing extremes, and further tests planned in EBR-11 with processed IFR fuel should provide a substantial and unique database for validating the computer codes being used to simulate postulated accident conditions.

706 (DPW–5392) **Slug failure: Decontamination experiments: W.A. Chren and W.M. Heston, ANL trip report, May**

8–9, 1952. Heston, W.M. Du Pont de Nemours (E.I.) and Co., Wilmington, DE (United States). Explosives Dept. 15 May 1952. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-76SR00001. (SR/H–222). Order Number DE93001455. Source: OSTI; NTIS (US Sales Only); GPO Dep.

A trip was made to ANL to review experimental work on the problem of slug failure and possible chemical contamination procedures. This memo reports the results of work on several chemical decontaminating reagents, operation of the slug failure loop, operation of the activity monitoring loop and discussions with metallurgical division personnel on accelerated corrosion problems.(JL)

707 (DPW–5410) **Accidental dropping of control rods: Minutes of meeting.** Carleton, J.T. Du Pont de Nemours (E.I.) and Co., Wilmington, DE (United States). Explosives Dept. 19 May 1952. 2p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-76SR00001. (SR/H–224). Order Number DE93001457. Source: OSTI; NTIS (US Sales Only); GPO Dep.

A meeting was held on May 13, 1952 to review problems associated with the accidental dropping of a control rod into the reactor.(JL)

708 (EGG-TMI–7757) **TMI-2 upper-core particle bed thermal behavior.** Kuan, P. EG and G Idaho, Inc., Idaho Falls, ID (United States). Aug 1987. 60p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92040953. Source: OSTI; NTIS; INIS; GPO Dep.

Models of dryout heat fluxes of particle beds believed to be applicable to the TMI-2 upper-core particle bed are reviewed and developed. A simplified Lipinski model and a model based on flooding are shown to agree between themselves and with experiments. These models are applied to the calculation of the dryout heat flux of the TMI-2 upper-core particle bed. The TMI-2 upper-core particle bed is shown to be: (a) coolable, if little heat is transferred to it from the consolidated region below, (b) only marginally coolable, if not uncoolable, before material relocation from the consolidated region, if most of the heat in the consolidiated region is transferred to it, and (c) coolable, after the relocation, regardless of heat transfer from the remaining consolidated region. Based on an analogy to quenching experiments, which show that the heat flux during the quench of a particle bed is approximately equal to the dryout heat flux, the time required to quench the TMI-2 upper-core particle bed from 2000 K to the saturation temperature of water during the accident is estimated. The bed was either quenched by 225 min after the initiation of the accident (assuming no heat was transferred to it from the consolidated region) or, at the latest, by 245 min (20 min after molten material relocation to the lower plenum from the consolidated region; assuming most of the heat generated in the consolidated region, both before and after the relocation, was transferred to the particle bed).

709 (HW–25742) **Recommended settings for 105-C trips.** Roy, G.M. Hanford Works, Richland, WA (United States). 25 Sep 1952. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93002078. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This memorandum discusses the engineered safety system which combines the Ball 3-X System with the VSR System. The operation of the system is detailed and settings are recommended for 105-C trips.

710 (HW–33999) **Reactor Section, radiation monitoring report for month of November 1954.** Jerman, P.C. Hanford Atomic Products Operation, Richland, WA (United States). 3 Dec 1954. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93001732. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This document details radiation monitoring activities of the Reactor Section during the month of November 1954.

711 (HW–34329) **Reactor Section, radiation monitoring report for month of December 1954.** Jerman, P.C. Hanford Atomic Products Operation, Richland, WA (United States). 5 Jan 1955. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93001734. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This document provides details of the radiation monitoring efforts of the Reactor Section during the month of December 1954.

712 (HW–36063) **Reactor Section, radiation monitoring report for month of March 1955.** Jerman, P.C. Hanford Atomic Products Operation, Richland, WA (United States). 5 Apr 1955. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93001736. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This document details radiation monitoring activities of the Reactor Section during the month of March 1955.

713 (HW–36546) **Reactor Section, radiation monitoring report for month of April 1955.** Jerman, P.C. Hanford Atomic Products Operation, Richland, WA (United States). 4 May 1955. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93001737. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This document details radiation monitoring activities of the Reactor Section during the month of April 1955.

714 (HW–84279) **Authorization request for potential noncompliance with the American Standard Safety Code for Elevators Dumbwaiters and Escalators.** Boyd, J.E. General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 28 Sep 1964. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93001231. Source: OSTI; NTIS (US Sales Only); GPO Dep.

A Third Party inspection of the reactor work platforms was conducted by representatives of the Travelers Insurance Company in 1958. An inspection report submitted by these representatives described hazardous conditions noted and presented a series of recommendations to improve the operational safety of the systems. Project CGI-960, "C" & "D" Work Platform Safety Improvements – All Reactors, vas initiated to modify the platforms in compliance with the Third Party recommendations. The American Standard Safety Code for Elevators Dumbwaiters and Escalators (A-17.1) is used as a guide by the Third Party in formulating their recommendations. This code is used because there is no other applicable code for this type of equipment. While the work platforms do not and in some cases can not comply with this code because of operational use, every effort is made to comply with the intent of the code.

715 (INIS-mf–13349, pp. 12-13) **Evaluation of the source related to reseach reactor accidents and its environmental effects.** Shams, M. (Sharif Univ. of Technology, Tehran (Iran). Physics Dept.); Afshare Bekeshloo, A. Iranian Physics Society, Teheran (Iran, Islamic Republic of). 1991. 53p. (In Persian). (CONF-9109417–: Iran's physics conference, Isfahan (Iran, Islamic Republic of), 10 Sep 1991). In *Abstract of articles from Iran's physics conference.* Order Number DE93000811. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. UTRR REACTOR/reactor safety; MAXIMUM CREDIBLE ACCIDENT; MAXIMUM PERMISSIBLE CONCENTRATION; MODIFICATIONS; SLIGHTLY ENRICHED URANIUM

716 (KAERI/RR–1068/91) **TRIGA mark-II,III reactor safety re-evaluation.** Jun, B. J. (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Park, S. J.; Hong, K. P.; Lee, J. P.; Oh, S. Y.; Kim, Y. J.; Kim, J. K.; Kang, T. J.; Youm, G. H.; Song, G. Y. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Jan 1991. 41p. (In Korean). Order Number DE93605591. Source: OSTI; NTIS (US Sales Only); INIS.

For two years of 1990 and 1991, the safety of TRIGA Mk-II and III reactor has been re-evaluated. For this, domestic rules on research reactors has been reviewed, and as it was judged that standards on research reactors in USA is applicable to our ones it was evaluated whether TRIGA Mk-II and III reactors satisfy these standards. The site parameters and the environmental impacts during normal operation and hypothetical accident conditions have been analysed, and those parts for reactor facility and structure have been rewritten to fit SAR standard format based on the review of old SAR and maintenance manuals reflecting changes after the construction. Based on this re-evaluation, SAR, Technical

Specifications, Radiation Emergency Plan, Environment Report, various procedures,etc. will be amended by the reactor management project. (Author).

717 (NUREG/CP–0122-Vol.1) **Proceedings of the Aging Research Information Conference: Volume 1.** Beranek, A. (comp.). Nuclear Regulatory Commission, Washington, DC (United States). Sep 1992. 556p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). (CONF-920375–Vol.1: Aging research information conference, Rockville, MD (United States), 24-27 Mar 1992). Source: OSTI; NTIS; INIS; GPO.

This report presents the proceedings of the Aging Research Information Conference held at the Holiday Inn Crowne Plaza in Rockville, Maryland, on March 24–27, 1992. This conference was held to disseminate research results in the area of nuclear power plant aging from programs sponsored by the Office of Nuclear Regulatory Research, US Nuclear Regulatory Commission. The papers and talks appear in the order in which they were presented at the conference, and they are grouped by technical session in two volumes. This document, Volume 1 contains the proceedings of March 24 and 25, while Volume 2 contains the proceedings of March 26 and 27.

718 (NUREG/CR–4674-Vol.15) **Precursors to potential severe core damage applications, 1991: A status report, main report and Appendix A.** Minarick, J.W. (Science Applications International Corp., Oak Ridge, TN (United States)); Dolan, B.W.; Cletcher, J.W.; Copinger, D.A. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Safety Programs; Oak Ridge National Lab., TN (United States). Sep 1992. 153p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC05-84OR21400. (ORNL/NOAC–232-Vol.15). Source: OSTI; NTIS; INIS; GPO.

Twenty-seven operational events with conditional probabilities of subsequent severe core damage of 1.0 x 10-6 or higher occurring at commercial light-water reactors during 1991 are considered to be precursors to potential severe core damage. These are described along with associated significance estimates, categorization, and subsequent analyses. This study is a continuation of earlier work, which evaluated 1969-1981 and 1984-1990 events. The report discusses (1) the general rationale for this study, (2) the selection and documentation of events as precursors, (3) the estimation and use of conditional probabilities of subsequent severe core damage to mnk precursor events, and (4) the plant models used in the analysis process.

719 (NUREG/CR–5787-Vol.1) **Timing analysis of PWR fuel pin failures: Volume 1, Main text and Appendices A–J: Final report.** Jones, K.R. (EG and G Idaho, Inc., Idaho Falls, ID (United States)); Wade, N.L.; Katsma, K.R.; Siefken, L.J.; Straka, M. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Safety Issue Resolution; EG and G Idaho, Inc., Idaho Falls, ID (United States). Sep 1992. 349p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC07-76ID01570. (EGG–2657-Vol.1). Source: OSTI; NTIS; INIS; GPO.

Research has been conducted to develop and demonstrate a methodology for calculation of the time interval between receipt of the containment isolation signals and the first fuel pin failure for loss-of-coolant accidents (LOCAs). Demonstration calculations were performed for a Babcock and Wilcox (B&W) design (Oconee) and a Westinghouse (W) four-loop design (Seabrook). Sensitivity studies were performed to assess the impacts of fuel pin burnup, axial peaking factor, break size, emergency core cooling system availability, and main coolant pump trip on these times. The analysis was performed using the following codes: FRAPCON-2, for the calculation of steady-state fuel behavior; SCDAP/RELAP5/MOD3 and TRACPF1/MOD1, for the calculation of the transient thermal-hydraulic conditions in the reactor system; and FRAP-T6, for the calculation of transient fuel behavior. In addition to the calculation of fuel pin failure timing, this analysis provides a comparison of the predicted results of SCDAP/RELAP5/MOD3 and TRAC-PFL/MOD1 for large-break LOCA analysis. Using SCDAP/RELAP5/MOD3 thermal-hydraulic data, the shortest time intervals calculated between initiation of containment isolation and fuel pin failure are 10.4 seconds and 19.1 seconds for the B&W and W plants, respectively. Using data generated by TRAC-PF1/MOD1, the shortest intervals are 10.3 seconds and 29.1 seconds for the B&W and W plants, respectively. These intervals are for a double-ended, offset-shear, cold leg break, using the technical specification maximum peaking factor and applied to fuel with maximum design burnup. Using peaking factors commensurate widi actual burnups would result in longer intervals for both reactor designs. This document also contains appendices A through J of this report.

720 (NUREG/CR–5787-Vol.2) **Timing analysis of PWR fuel pin failures: Volume 2, Appendices K–L: Final report.** Jones, K.R. (EG and G Idaho, Inc., Idaho Falls, ID (United States)); Wade, N.L.; Katsma, K.R.; Siefken, L.J.; Straka, M. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Safety Issue Resolution; EG and G Idaho, Inc., Idaho Falls, ID (United States). Sep 1992. 409p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC07-76ID01570. (EGG–2657-Vol.2). Source: OSTI; NTIS; INIS; GPO.

This report discusses research conducted to develop and demonstrate a methodology for calculation of the time interval between receipt of the containment isolation signals and the first fuel pin failure for loss-of-coolant accidents (LOCAs). Demonstration calculations were performed for a Babcock and Wilcox (B&W) design (Oconee) and a Westinghouse (W) four-loop design (Seabrook). Sensitivity studies were performed to assess the impacts of fuel pin burnup, axial peaking factor, break size, emergency core cooling system availability, and main coolant pump trip on these times. The analysis was performed using the following codes: FRAPCON-2, for the calculation of steady-state fuel behavior; SCDAP/RELAP5/MOD3 and TRACPF1/MOD1, for the calculation of the transient thermal-hydraulic conditions in the reactor system; and FRAP-T6, for the calculation of transient fuel behavior. In addition to the calculation of fuel pin failure timing, this analysis provides a comparison of the predicted results of SCDAP/RELAP5/MOD3 and TRAC-PF1/MOD1 for large-break LOCA analysis. Using SCDAP/RELAP5/MOD3 thermal-hydraulic data, the shortest time intervals calculated between initiation of containment isolation and fuel pin failure are 10.4 seconds and 19.1 seconds for the B&W and W plants, respectively. Using data generated by TRAC-PF1/MOD1, the shortest intervals are 10.3 seconds and 29.1 seconds for the B&W and W plants, respectively. These intervals are for a double-ended, offset-shear, cold leg break, using the technical specification maximum peaking factor and applied to fuel with maximum design burnup. Using peaking factors commensurate with actual burnups would result in longer intervals for both reactor designs. This document provides appendices K and L of this report which provide plots for the timing analysis of PWR fuel pin failures for Oconee and Seabrook respectively.

721 (NUREG/CR–5910) **Loss of essential service water in LWRs (GI-153): Scoping study.** Cramond, W.R. (Sandia National Labs., Albuquerque, NM (United States)); Mitchell, D.B.; Yakle, J.L.; Miller, S.P. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Safety Issue Resolution; Sandia National Labs., Albuquerque, NM (United States). Aug 1992. 361p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC04-76DP00789. (SAND–92-1084). Source: OSTI; NTIS; INIS; GPO.

The contribution of essential service water (ESW) system failure to core damage frequency has long been a concern of the NRC. The objective of this study is to assess the safety significance of the loss of ESW systems in LWRs relative to core damage frequency (CDF) and perform a limited value/impact analysis of potential modifications to solve ESW vulnerabilities using a prototypical (pilot) plant. Previous studies indicate that service water systems contribute from < 1% to 65% of the total internal CDF. For the pilot plant analyzed, common ESW vulnerabilities are failure of standby service water pumps to start, backflow through check valves for cross-tied pumps, and failure of normally closed isolation valves in diesel generator cooling loops to open on demand. For the potential modifications evaluated for the pilot plant, the results showed that they could reduce the CDF by as much as 33 percent. However, the dollars per person REM measures resulting from various groups of these modifications significantly exceeded the

current criteria of $1000. The results, since they only apply to the prot plant, are not typical of all LWRs. Due to the importance of service water to CDF and the plant specific nature of ESW systems, there could be plants for which there would be cost-effective modifications. Additional analysis would be required to identify them.

722 (NUREG/CR–5930) **High integrity software standards and guidelines.** Wallace, D.R. (National Inst. of Standards and Technology, Gaithersburg, MD (United States)); Ippolito, L.M.; Kuhn, D.R. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Systems Research; National Inst. of Standards and Technology, Gaithersburg, MD (United States). Sep 1992. 103p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). (NIST/SP–500-204). Source: OSTI; NTIS; INIS; GPO.

This report presents results of a study of standards, draft standards, and guidelines (all of which will hereafter be referred to as documents) that provide requirements for the assurance of software in safety systems in nuclear power plants. The study focused on identifying the attributes necessary in a standard for providing reasonable assurance for software in nuclear systems. The study addressed some issues involved in demonstrating conformance to a standard The documents vary widely in their requirements and the precision with which the requirements are expressed. Recommendations are provided for guidance addressing the assurance of high integrity software. It is recommended that a nuclear industry standard be developed based on the documents reviewed in this study with additional attention to the concerns identified in this report.

723 (ORNL/NSP–92/1) **Status of conversion of DOE standards to non-Government standards.** Moseley, H.L. Oak Ridge National Lab., TN (United States). Jul 1992. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93000546. Source: OSTI; NTIS; GPO Dep.

One major goal of the DOE Technical Standards Program is to convert existing DOE standards into non-Government standards (NGS's) where possible. This means that a DOE standard may form the basis for a standards-writing committee to produce a standard in the same subject area using the non-Government standards consensus process. This report is a summary of the activities that have evolved to effect conversion of DOE standards to NGSs, and the status of current conversion activities. In some cases, all requirements in a DOE standard will not be incorporated into the published non-Government standard because these requirements may be considered too restrictive or too specific for broader application by private industry. If requirements in a DOE standard are not incorporated in a non-Government standard and the requirements are considered necessary for DOE program applications, the DOE standard will be revised and issued as a supplement to the non-Government standard. Tne DOE standard will contain only those necessary requirements not reflected by the non-Government standard. Therefore, while complete conversion of DOE standards may not always be realized, the Department's technical standards policy as stated in Order 1300.2A has been fully supported in attempting to make maximum use of the non-Government standard.

724 (PNL-SA–18921) **ASME development of risk-based inspection guidelines for nuclear power plants.** Gore, B.F.; Balkey, K.R. Pacific Northwest Lab., Richland, WA (United States). Aug 1992. 8p. Sponsored by USDOE, Washington, DC (United States); Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-9208103–2: INTER-RAMQ conference for electric power industry, Philadelphia, PA (United States), 25-28 Aug 1992). Order Number DE93001311. Source: OSTI; NTIS; INIS; GPO Dep.

A methodology has been developed for use in preparing guidelines for the in-service inspection of nuclear power plant pressure boundary and structural components. This methodology is a further development of a general methodology previously published by the task force for application to any industry. It is unique in that it utilizes probabilistic risk assessment (PRA) information to improve the quantification of risks associated with component ruptures. A procedure has also been recommended for using the resulting quantified risk estimates to determine target component rupture probability values to be maintained by inspection activities. Characteristics which an inspection strategy must possess in order to maintain target rupture probabilities are being determined by structural risk and reliability analysis (SRRA) calculations. The major features of this methodology are described in this paper, and example applications are briefly discussed. Plans for additional work in developing and applying the methodology are described.

725 (SAND–92-1241) **Results of an experiment in a Zion-like geometry to investigate the effect of water on the containment basement floor on direct containment heating (DCH) in the Surtsey Test Facility: The IET-4 test.** Allen, M.D. (Sandia National Labs., Albuquerque, NM (United States)); Blanchat, T.K.; Pilch, M.; Nichols, R.T. Sandia National Labs., Albuquerque, NM (United States). Sep 1992. 76p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93002514. Source: OSTI; NTIS; INIS; GPO Dep.

This document discusses the fourth experiment of the Integral Effects Test (IET-4) series which was conducted to investigate the effects of high pressure melt ejection on direct containment heating. Scale models (1:10) of the Zion reactor pressure vessel (RPV), cavity, instrument tunnel, and subcompartment structures were constructed in the Surtsey Test Facility at Sandia National Laboratories. ne RPV was modeled with a melt generator that consisted of a steel pressure barrier, a cast MgO crucible, and a thin steel inner liner. The melt generator/crucible had a hemispherical bottom head containing a graphite limitor plate with a 3.5-cm exit hole to simulate the ablated hole in the RPV bottom head that would be tonned by tube ejection in a severe nuclear power plant accident. The reactor cavity model contained 3.48 kg of water with a depth of 0.9 cm that corresponded to condensate levels in the Zion plant. A 43-kg initial charge of iron oxide/aluminum/chromium thermite was used to simulate corium debris on the bottom head of the RPV. Molten thermite was ejected into the scaled reactor cavity by 6.7 MPa steam. IET-4 replicated the third experiment in the IET series (IET-3), except the Surtsey vessel contained slightly more preexisting oxygen (9.6 mol.% vs. 9.0 mol.%), and water was placed on the basement floor inside the crane wall. The cavity pressure measurements showed that a small steam explosion occurred in the cavity at about the same time as the steam explosion in IET-1. The oxygen in the Surtsey vessel in IET-4 resulted in a vigorous hydrogen bum, which caused a significant increase in the peak pressure, 262 kPa compared to 98 kPa in the IET-1 test. EET-3, with similar pre-existing oxygen concentrations, also had a large peak pressure of 246 kPa.

726 (SAND–92-2026C) **Phenomenological direct containment heating models in CONTAIN and their assessment against experimental data.** Washington, K.E.; Griffith, R.O. Sandia National Labs., Albuquerque, NM (United States). [1992]. 3p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-921007–1: 20. water reactor safety information meeting, Bethesda, MD (United States), 21-23 Oct 1992). Order Number DE92041154. Source: OSTI; NTIS; INIS; GPO Dep.

In previous years, a suite of interim models had been developed for the CONTAIN code for analyzing direct containment heating (DCH) accidents. The initial development and application of these DCH models are described in a previous WRS paper. While useful, these interim models were incomplete and were highly parametric. The parametric nature of the interim CONTAIN DCH models was necessary at the time because of the lack of relevant DCH experimental data, and to facilitate sensitivity studies aimed at improving our understanding of the most important governing processes in a DCH event. However, today our understanding of DCH phenomenology is significantly improved from when the interim DCH models were developed. This understanding largely stems from recently completed NRC-sponsored DCH experiments at Sandia National Laboratories and Argonne National Laboratory. New models have been developed and added to the CONTAIN code for modeling DCH events to reflect this improvement in our understanding of DCH. The purpose of this paper is to describe the new DCH models in CONTAIN. A demonstration of the new models by comparing simplified calculations against relevant DCH test data

will also be presented in this paper. This paper is an extension of the preliminary descriptions of the DCH model improvements presented in the 19th WRS paper. The new models that have been added to CONTAIN for analyzing DCH are briefly discussed below. The following paragraphs also include brief discussions of the motivation and/or basis for the developed improvement. The models are described in greater detail in the full paper.

24 POWER TRANSMISSION AND DISTRIBUTION

2401 Power Systems

Refer also to citation(s) 374, 728, 815

727 (ETDE-IT–92-78) **Possibilities and expectations for improved man-machine interface in power system control.** Asal, H.; Burrow, R.K.; Lindstrom, K.; Mocenigo, M.; Schellstede, G.; Schaffer, G.; Serrani, A. Ente Nazionale per l'Energia Elettrica, Milan (Italy). May 1992. 9p. Order Number DE93729407. Source: OSTI; NTIS (US Sales Only).

The paper describes the hardware, equipment and functions provided to operators for supervising and controlling HVAC power systems. It analyzes the main elements of the man-machine interface (MMI) with particular attention to the recent possibilities afforded by computer technology and full graphic screens. Alarm management and remote control operation are briefly described.

2402 Power System Networks, Transmission and Distribution

Refer also to citation(s) 795

2403 Power Transmission Lines and Cables

Refer also to citation(s) 1208

728 (CONF-920944–2) **Potential impact of superconductivity on power quality enhancement.** McConnell, B.W. Oak Ridge National Lab., TN (United States). [1992]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 6. annual New York State Institute on Superconductivity (NYSIS) conference on superconductivity and applications; Buffalo, NY (United States); 15-17 Sep 1992. Order Number DE93000450. Source: OSTI; NTIS; GPO Dep.

Electric power quality problems are estimated to cost US industry $26 billion dollars per year in lost production. This paper provides a summary of the problem's magnitude, an overview of the underlying causes, discusses the present methods used by industry to reduce the problem's impact and the associated cost, and examines the potential for superconducting technology to effect alternative solutions. The present market for uninterruptible power supplies (UPS) and power conditioners is also discussed and the benefits of applying high temperature superconductors (HTS) are summarized.

729 (ETDE-IT–92-82) **Materials performances in composite insulators during aging.** Sandrolini, F.; Motori, A.; Marrone, G.; Fini, G.P. Ente Nazionale per l'Energia Elettrica, Milan (Italy). Centro di Ricerca Elettrica; Bologna Univ. (Italy). 1991. 16p. Order Number DE93729443. Source: OSTI; NTIS (US Sales Only).

The evaluation of the aging of organic materials for HV electrical insulation under service and laboratory stresses has been carried out by the authors for a long time. The effects of different aging conditions on significant chemical-physical and electrical properties, as well as, on the microstructure of insulating materials for HV components and cables are currently being investigated. In particular, the study of dc and ac electrical behaviour has proved to be very effective in pointing out correlations with the molecular structure (charge carriers, relaxation processes, etc.) of organic materials and changes due to aging. In this paper, the preliminary results concerning the effects of multiple environmental-electrical-mechanical aging on the electrical properties (dc electrical conductivity, ac dielectric constant and loss factor) and microstructure of materials used in HV composite insulators subjected to laboratory and field aging are presented and discussed.

730 (ETDE-IT–92-92) **Review of medium voltage EPR insulated cables used in Italy for public distribution.** Farneti, F.; Gasparini, G. Ente Nazionale per l'Energia Elettrica, Milan (Italy). Centro di Ricerca Elettrica. 1991. 9p. Order Number DE93729459. Source: OSTI; NTIS (US Sales Only).

In Italy, only EPR-extruded insulated cables are to be standardized and used in medium voltage (MV) systems. Standards have been issued by the Italian Electrotechnical Committee and are currently based on those of the International Electrotechnical Committee, at least as far as test methods are concerned. However, ENEL (Italian National Electricity Board) has developed its own manufacturing, operating and test specifications for the following reasons: historically, national standards for EPR-insulated cables were formulated to suit industrial needs (the MV public distribution network, in the past, used only paper-insulated cables); EPR cables are now being introduced into the public network, and it is expected that they will be used consistently. ENEL, in cooperation with cable manufacturers, prepared specifications which took into account the following aspects: differences in underground installation methods; the more critical nature of installation site access; the need to provide the public with high quality service with better-than-industrial failure rate tolerances; and the capability of monitoring changes in the materials or processes used by the manufacturers. These factors have prompted ENEL to revise the Italian cable standardization approach with regard to, not only cable design adequacy, but also to the manufacturer's ability to provide regular supplies and methods to establish cable reliability.

2404 Health and Safety

Refer also to citation(s) 727, 1208, 1768, 1769

731 (NEI-DK–982) **Dwellings located close to high-voltage systems and the risk of cancer development in children: Background paper.** Olsen, J.H. (Kraeftens Bekaempelses Cancerregister, Copenhagen (DK)); Nielsen, A.; Bautz, A.; Larsen, V.B.; Schulgen, G. Landsforeningen til Kraeftens Bekaempelse, Copenhagen (Denmark). Cancerregisteret. Oct 1992 16p. (In Danish). Order Number DE93721440. Source: OSTI; NTIS.

140 new cases of cancer in children under the age of 14 years are diagnosed each year in Denmark. Of these ca. 45 are leukemia cases. In 1979 two American researchers announced that they had found that cancer risk was greater for children who lived close to high voltage electric cables, within a magnetic field. This finding has later been criticised. The authors's aim was to evaluate the hypotheses that habitation close to high voltage cables and transformers increases the risk of children developing leukemia, brain tumours and cancer in the lymph system, and that the risk of contracting these forms of cancer increases in relation to the strength of the magnetic fields. The investigation was carried out in such a way that it was possible to make adjustments according to social and economic conditions and geographical factors. The groups investigated and the methods used are described and details of the conditions are given. The results of the investigation are presented in the form of statistics and graphs. It is concluded that the risk of cancer in the lymph system is increased amongst children living within the range of magnetic fields (surrounding electric cables) of 0.1 μT or more, which answers to a housing location of 25-50 meters from the most powerful transmission systems. It is pointed out that the investigation encompassed a small number of children. Nationally, it is reckoned that ca. 4000 children are exposed to magnetic fields of at least 0.1 μ T, of which ca. 600 are exposed to 0.4 μT or more in Denmark today. (AB).

2405 Environmental Aspects

732 (DOE/BP–93000392) **Bonneville Power Administration 1991 site environmental report.** USDOE Bonneville Power Administration, Portland, OR (United States). Jun 1992. 35p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93000392. Source: OSTI; NTIS; GPO Dep.

In 1991, in order to provide BPA's management with environmental information for decision making, and to comply with the National Environmental Policy Act (NEPA) of 1969, BPA completed 15 environmental impact evaluations and decision documents, with many more in progress. BPA received the results of two US Department of Energy (DOE) environmental management audits, which noted areas for improvement in our operations. We completed Action Plans in response to each DOE report. We received one administrative complaint from the US Environmental Protection Agency (EPA) concerning a 1990 spill in Arlington, Oregon, caused by a BPA subcontractor. BPA responded promptly to EPA's findings and concerns. There were 32 new spill/release incidents, most involving failure of Polychlorinated biphenyl (PCB) capacitors. Cleanup of these spills/releases has proceeded satisfactorily. BPA continued vigorous efforts to clean up substations contaminated with residuals of oil and PCB from past spills. BPA took several actions to improve our environmental performance with respect to water quality. The BPA environmental team developed a long-term schedule for environmental appraisals and audits, identifying facilities and projects that will receive audits through 1996.

733 (DOE/EA–0737) **Fort Peck-Wolf Point transmission line project, Montana: Final environmental assessment.** USDOE Western Area Power Administration, Billings, MT (United States). Billings Area Office. 1992. 166p. Sponsored by USDOE, Washington, DC (United States). Order Number DE92040951. Source: OSTI; NTIS; INIS; GPO Dep.

The primary objective of the project is to replace the existing 36-mile Fort Peck-Wolf Point transmission line which has reached the end of its useful service life. Presently, the overall condition of this existing section of the 47-year-old line is poor. Frequent repairs have been required because of the absence of overhead ground wires. The continued maintenance of the line will become more expensive and customer interruptions will persist because of the damage due to lightning. The expense of replacing shell rotted poles, and the concern for the safety of the maintenance personnel because of hazards caused by severe shell rot are also of primary importance. The operational and maintenance problems coupled with power system simulation studies, demonstrate the need for improvements to the Wolf Point area to serve area loads. Western's Wolf Point Substation is an important point of interconnection for the power output from the Fort Peck Dam to area loads as far away as Williston, North Dakota. The proposed transmission line replacement would assure that there will continue to be reliable transmission capacity available to serve area electrical loads, as well as provide a reliable second high-voltage transmission path from the Fort Peck generation to back-up a loss of the Fort Peck-Wolf Point 115-kV Line No. 1.

734 (EGG–10617-2129) **Endangered species preactivity survey and monitoring program for Western Area Power Administration's Tracy-Livermore 230-kV transmission line construction: Final report.** EG and G Energy Measurements, Inc., Goleta, CA (United States). Santa Barbara Operations. Jan 1992. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC08-88NV10617. Order Number DE92040480. Source: OSTI; NTIS; GPO Dep.

The Department of Energy (DOE), San Francisco Field Office, requested the establishment of a transmission line between Lawrence Livermore National Laboratory (LLNL) and the Western Area Power Administration (Western) Tracy Substation near Byron, California. Western was responsible for providing this interconnection by designing, constructing, operating, and maintaining the 230-kV transmission line between the Tracy Substation and a new substation at LLNL. The 12.6 mile proposed transmission line route and alternative routes were surveyed in 1986 and 1987. These surveys were used to write a Biological Assessment of the effects of construction and operation of the proposed transmission line on threatened and endangered species and species of concern. On February 1, 1988, Western requested formal consultation with the US Fish and Wildlife Service (FWS) to determine potential impacts of the proposed project on the federally listed endangered San Joaquin kit fox (Vulpes macrotis mutica) and palmate-bracted bird's beak (Cordylanthus palmatus). FWS further required that a report be issued upon project completion which would: detail results; address the adequacy of mitigation and conservation measures; document difficulties encountered in implementing the measures; and recommend improvements in protective measures to be applied towards future projects. This report has been prepared to meet these requirements.

2407 Economic, Industrial, and Business Aspects

735 (GB–462) **Annual review and directors' report and accounts.** Midlands Electricity plc, Halesowen (United Kingdom). Jul 1992 64p. Order Number DE93729521. Source: OSTI; NTIS (US Sales Only); INIS.

This annual report of Midlands Electricity PLC (MEB) presents a financial review of the Group and the directors' and auditors reports. Historical and current cost profit and loss accounts, balance sheets and cash flow statements are tabulated. The Group's financial history and regulatory accounts are also presented. (UK).

25 ENERGY STORAGE

2501 Magnetic

Refer also to citation(s) 2201

736 (ANL/CP–77105) **Design aspects of mid-size SMES using high temperature superconductors.** Schoenung, S.M. (Schafer (W.J.) Associates, Inc., Livermore, CA); Meier, W.R.; Hull, J.R.; Fagaly, R.L.; Heiberger, M.; Stephens, R.B.; Leuer, J.A.; Guzman, R.A. Argonne National Lab., IL (United States). [1992]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-920802–6: Applied superconductivity conference, Chicago, IL (United States), 23-28 Aug 1992). Order Number DE92040723. Source: OSTI; NTIS; GPO Dep.

Conceptual designs of modular, cold-supported SMES units using high temperature superconductors (HTS) have been investigated over the mid-size energy range of 2 to 200 MWh (7.2 to 720 GJ). This size range covers many utility, industrial, and military applications. Both toroidal and solenoidal configurations were analyzed to determine physical dimensions, heat loads and cost of major components. Among the effects considered were the impact of critical current density on feasible configurations, mass of conductor, and cost; the effects of magnetic field and strain limits on physical parameters and structural mass; and the savings in refrigeration from operating at high temperature. The design of the HTS conductor, stability criteria, and coolant selection are also discussed.

737 (CONF-920944–3) **Magnetic refrigeration cycle analysis using selected thermodynamic property characterizations for gadolinium gallium garnet.** Murphy, R.W. Oak Ridge National Lab., TN (United States). Sep 1992. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 6. annual New York State Institute on Superconductivity (NYSIS) conference on superconductivity and applications; Buffalo, NY (United States); 15-17 Sep 1992. Order Number DE93000448. Source: OSTI; NTIS; GPO Dep.

Magneto-thermodynamic property characterizations were selected, adapted, and compared to material property data for gadolinium gallium garnet in the temperature range 4–40 K and magnetic field range 0–6 T. The most appropriate formulations were incorporated into a model in which methods similar to those previously developed for other materials and temperature ranges were used to make limitation and relative performance assessments of Carnot, ideal regenerative, and pseudo-constant field regenerative cycles. Analysis showed that although Carnot cycle limitations on available temperature lift for gadolinium gallium garnet are not as severe as those for materials previously examined, substantial improvements in cooling capacity/temperature lift combinations can be achieved using regenerative cycles within specified field limits if significant loss mechanisms are mitigated.

2506 Thermal

738 (BFR-R–21-92) **Heat storage in clay.** Magnusson, C. (Geotechnical Inst., Linkoeping (SE)). Swedish Council for Building Research, Stockholm (Sweden). 1992. 84p. (In Swedish). Project BFR-860805-5. Order Number DE93721675. Source: OSTI; NTIS.

Heat pumps are used for charging and extracting heat to a clay layer, in a space heating system for a school and a sports area. The technical and economic performances of the heat store are evaluated. Operational experiences and collected data are analyzed. The performance of the heat exchangers show good agreement with simulations. The geotechnical examinations show small variations of parameters, settlements are less than 13 cm. (18 refs., 41 figs.).

739 (PNL-SA–20796) **Geohydrologic characterization for aquifer thermal energy storage.** Hall, S.H.; Raymond, J.R. Pacific Northwest Lab., Richland, WA (United States). Aug 1992. 23p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-920801–24: 27. intersociety energy conversion engineering conference, San Diego, CA (United States), 3-7 Aug 1992). Order Number DE92041333. Source: OSTI; NTIS; GPO Dep.

Successful operation of an aquifer thermal energy storage system depends on three elements: (1) the presence of a suitable aquifer for ground-water supply and energy storage; (2) the availability of a source of free or low-cost thermal energy, such as industrial waste heat or environmental chill; and (3) a temporal mismatch between thermal energy availability and thermal energy use. Using conventional hydrogeologic methods for aquifer characterization, the presence of a suitable aquifer is the most difficult of these three elements to assess quantitatively. By combining conventional methods with drift-and-pumpback and point-dilution single-well tracer tests, however, the rate of ground-water flow, the effective porosity, and the vertical distribution of hydraulic conductivity of the aquifer can be estimated quickly and economically.

740 (PNL-SA–21032) **Review of the aquifer seasonal thermal energy storage building HVAC system at the Melville, New York, Mid-Island Mall Facility.** Marseille, T.J.; Wilke, D.A. Pacific Northwest Lab., Richland, WA (United States). Aug 1992. 7p. Sponsored by USDOE, Washington, DC (United States); New York State Energy Research and Development Authority, Albany, NY (United States); Florida Atlantic Univ., Boca Raton, FL (United States). DOE Contract AC06-76RL01830. (CONF-920801–25: 27. intersociety energy conversion engineering conference, San Diego, CA (United States), 3-7 Aug 1992). Order Number DE92041330. Source: OSTI; NTIS; GPO Dep.

The successful widespread commercialization of aquifer thermal energy storage (ATES) in the United States will depend on the effectiveness with which the experiences gained from early full-scale systems are used as guides in the design, installation and operation of future projects. One such early system from which both anecdotal and quantitative information is available is the Mid-Island Postal Facility in Melville, New York. At this facility, built in the mid-1980s, an ATES system has been integrated with the building's central heating and cooling plant. "Cold" wells are charged with water that is cooled during the winter by heat pump and closed circuit cooler operation. Water from these cold wells is then used to meet the facility's cooling load during the summer, before being pumped back into the ground at "Warm" wells. Dehumidification during summer operation is accomplished by a liquid desiccant system that uses propane boilers to provide a heat source for desiccant regeneration. This system will also add water to the air during periods of low humidity. This paper provides an overview of the project, and describes the analysis being performed to assess energy and economic merits of this innovative system.

2509 Batteries

Refer also to citation(s) 374

741 (LBL–32395) **Effect of ion implantation on the corrosion behavior of lead and lead-antimony alloy.** Muller, R.H.; Zhang, S.T. Lawrence Berkeley Lab., CA (United States). May 1992. 2p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-921036–7: 182. meeting of the Electrochemical Society, Toronto (Canada), 11-16 Oct 1992). Order Number DE92041180. Source: OSTI; NTIS; GPO Dep.

Short communication. LEAD BASE ALLOYS/ion implantation; ANTIMONY ALLOYS/ion implantation; LEAD/ion implantation; LEAD-ACID BATTERIES/corrosion; LEAD; CORROSION; CORROSION RESISTANCE; MATERIALS; TITANIUM

742 (LBL–32538) **The electrical conductivity of sodium polysulfide melts.** Meihui Wang. Lawrence Berkeley Lab., CA (United States). Jun 1992. 95p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. Order Number DE92041217. Source: OSTI; NTIS; GPO Dep.

The sodium polysulfide melt has been described by a macroscopic model. This model considers the melt to be composed of sodium cations, monosulfide anions, and neutral sulfur solvent. The transport equations of concentrated-solution theory are used to derived the governing equations for this binaryelectrolyte melt model. These equations relate measurable transport properties to fundamental transport parameters. The focus of this research is to measure the electrical conductivity of sodium polysulfide melts and calculate one of fundamental transport parameters from the experimental data. The conductance cells used in the conductivity measurements are axisymmetric cylindrical cells with a microelectrode. The electrode effects, including double-layer capacity, charge transfer resistance, and concentration overpotential, were minimized by the use of the alternating current at an adequately high frequency. The high cell constants of the conductance cells not only enhanced the experimental accuracy but also made the electrode effects negligible. The electrical conductivities of sodium polysulfide Na_2S_4 and Na_2S_5 were measured as a function of temperature (range: 300 to 360°C). Variations between experiments were only up to 2%. The values of the Arrhenius activation energy derived from the experimental data are about 33 kJ/mol. The fundamental transport parameter which quantifies the interaction within sodium cations and monosulfide anions are of interest and expected to be positive. Values of it were calculated from the experimental conductivity data and most of them are positive. Some negative values were obtained probably due to the experimental errors of transference number, diffusion coefficient, density or conductivity data.

29 ENERGY PLANNING AND POLICY

Refer also to citation(s) 2394

743 (DOE/ER/75650–1) **Ventures in science status report, Summer 1992.** City Colleges of Chicago Harry S. Truman Coll., IL (United States). [1992]. 49p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-91ER75650. Order Number DE93003044. Source: OSTI; NTIS; GPO Dep.

The Ventures in Science summer program is directed towards students who are from underrepresented minority groups in mathematics and science professions. The target group of 40 was drawn from eligible students who will be entering high school freshman in the fall of 1992. 450 students applied. The theme for the summer is Chicago as an Ecosystem. The students are instructed in integrated math and science (2 hours), English/ESL (1 1/2 hrs.), counseling (1 hr.) and, physical education (1 hr.) each day four days a week. Integrated math and science are team taught. Parents are invited to participate in two workshops that will be presented based on their input. Parents may also visit the program at any time and participate in any field trip.

744 (DOE/ER/75658–1) **The Alabama Experimental Program to Stimulate Competitive Research: Department of Energy traineeship grant: Progress performance report.** Alabama Univ., Birmingham, AL (United States). 20 Mar 1992. 365p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-91ER75658. Order Number DE93000425. Source: OSTI; NTIS; GPO Dep.

In 1991, the State of Alabama EPSCoR program was awarded DOE/EPSCoR Planning and Traineeship Grants to begin the processes needed to identify, then develop, a strong energy-related research and educational consortium involving industry, state and federal government, and, the six EPSCoR universities in the state.

Basically, Broad-based interests derived from early faculty surveys were used to direct recruitment activities identifying highly qualified students. Conversely, the broadly defined research thrust areas outlined in the Traineeship Grant were, in turn, used to develop campus visitation programs designed to measure institutional strength and commitment for energy-related research and education. The result of this type of synergism between the two DOE grants was that activities developed at higher levels of visibility, economy, efficiency and effectiveness – all of which enabled the directors to achieve a large number of targeted objectives over a short period of time. Likewise, the interest and enthusiasm generated during the early phases among faculty and students continue as both programs solicit proposals in directed RFP's for national peer review and, ultimately, for inclusion ion the Alabama Implementation Proposals later this year.

745 (DOE/ER/75660–1) **Mississippi graduate DOE EPSCor trainee project: First annual summary report.** Wertz, D.L. University of Southern Mississippi, Hattiesburg, MS (United States). Aug 1992. 36p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-91ER75660. Order Number DE92041115. Source: OSTI; NTIS; GPO Dep.

The promotion of an aggressive energy research initiative was identified as a goal of the Mississippi Research Consortium (MRC) from its inception in 1986. The Department of Energy EPSCOR Program has provided opportunities to address the needs and enhance the interactive programs of energy-related research in the State of Mississippi. The Mississippi DOE EPSCOR Graduate Traineeships Project is a program of education and research which will (1) increase the number of trained professionals in the energy sciences and technology, particularly those from groups traditionally under-represented in the field, and (2) interface with existing networks of universities, industry, federal, and state institutions involved in energy-related activities.

746 (DOE/ER/75663–1) **South Carolina DOE/EPSCoR energy-related graduate research traineeships: Progress performance report, September 30, 1991–September 29, 1992.** Durig, J.R. South Carolina Univ., Columbia, SC (United States). [1992]. 24p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-91ER75663. Order Number DE92041117. Source: OSTI; NTIS; GPO Dep.

The three primary objectives of the DOE/EPSCOR Traineeship Grant are to increase the number of US graduates with training in energy-related disciplines; to provide training and research experience through active participation in on-going energy research programs; and to ensure that the trainees obtain a broader understanding of energy-related research and technology.

747 (DOE/ER/75681–1) **MT DOE/EPSCoR planning grant: Annual technical progress report.** Bromenshenk, J.J.; Scruggs, V.L. Montana Univ., Missoula, MT (United States). 31 Aug 1992. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-91ER75681. Order Number DE92041116. Source: OSTI; NTIS; GPO Dep.

The Montana DOE/EPSCoR planning process has made significant changes in the state of Montana. This is exemplified by notification from the Department of Energy's Experimental Program to Stimulate Competitive Research (DOE/EPSCoR) recommendation to fund Montana's 1992 graduate traineeship grant proposal in the amount of $500,000. This is a new award to Montana. DOE traineeship reviewers recognized that our planning grant enabled us to develop linkages and build the foundation for a competitive energy-related research and traineeship program in Montana. During the planning, we identified three major focus areas: Energy Resource Base, Energy Production, and Environmental Effects. For each focus area, we detailed specific problem areas that the trainees may research. We also created MORE, a consortium of industrial affiliates, state organizations, the Montana University System (MUS), tribal colleges, and DOE national laboratories. MORE and our state-wide Research and Education Workshop improved and solidified working relationships. We received numerous letters of support. DOE reviewers endorsed our traineeship application process. They praised the linkage of each traineeship with a faculty advisor, and the preference for teams of faculty members and two or more students. "Particularly commendable" were our programs to involve Native American educators and the "leveraging effect" of this on the human resources in the state. Finally, the DOE reviewers indicated that cost-sharing via support of Native Americans was creative and positive.

748 (DOE/ER/75682–1-Pt.4) **Kansas energy 2000: DOE/EPSCoR: Inventory of energy related assets, Wichita State University: [Annual report].** Legg, J.; Nellis, D.; Simons, G. Kansas State Univ., Manhattan, KS (United States). Mar 1992. 36p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-91ER75682. Order Number DE93001488. Source: OSTI; NTIS; GPO Dep.

The US Department of Energy is one of several federal agencies which has initiated an Experimental Program to Stimulate Competitive Research (EPSCoR). Generally, this program is intended to enhance the competitive ability of states that are underrepresented in the receipt of funds for research from federal agencies. Kansas State University, The University of Kansas, and Wichita State University, have received support from the US Department of Energy to begin the EPSCoR process in Kansas. The specific purposes of the DOE/EPSCoR program are to enhance the capability of Kansas to develop science and engineering personnel in energy-related areas and to conduct nationally competitive energy-related research.

749 (KTM/E-B–110) **IEA review of Finnish Energy policies 1991: IEA report 1991.** Ministry of Trade and Industry, Helsinki (Finland). 1992. 45p. (In Finnish). Order Number DE93721597. Source: OSTI; NTIS.

The International Energy Agency IEA reviewed the Finnish energy policy for the first time in 1991, as Finland was to join the organisation in the beginning of 1992. IEA analyzes annually member countries' energy situation and energy policies and gives recommendations to governments in this field. This report contains the Finnish review and it is a translated extract from the IEA country review report 'Energy Policies of IEA Countries - 1991 Review' to be published later. The report examines thoroughly energy demand and supply issues. Environment, development of energy technology and competition in the energy market receive attention as well. In general, the IEA assessment of the Finnish energy policy is quite positive. Policy is in line with the IEA objectives: the efficiency of the energy system has been continually improved, market-oriented elements have been introduced and the share of oil has declined considerably. There are, however, needs for further development. The main challenges, according to the IEA, are to assure compatibility of the partly conflicting goals of energy, economic and environment policies; to further improve energy efficiency; and to ensure sufficient capacity to meet growing demand for electricity. The most critical remarks focus on government subsidies and competitive conditions of the energy market. In particular, IEA pays attention to tax subsidies through VAT-system for indigenous fuels and natural gas, and to investment subsidies for infrastructure projects. The Agency considers that these may distort energy markets. The government should also ensure that enterprises in dominant position do not abuse their position.

2901 Energy Analysis and Modeling

Refer also to citation(s) 788, 1497

750 (SA-PUB–9/89-Vol.1, pp. 158-166) **A validation of residual energy budgets from atmospheric circulation data against satellite measurements of the net radiation.** Fortelius, C. (Helsinki Univ. (Finland). Dept. of Meteorology). Academy of Finland, Helsinki (Finland). 1989. (CONF-8909491–Vol.1: Conference on climate and water, Helsinki (Finland), 11-15 Sep 1989). In *Conference on climate and water: Volume 1.* 520p. Order Number DE93721620. Source: OSTI; NTIS.

The distributions of the net sources of atmospheric dry and latent energy are evaluated by the residual technique, using the reanalyzed ECMWF FGGE level IIIb data for February and July 1979. Their sum (i.e., the estimated source of total energy) is compared to simultaneous Nimbus 7 ERB estimates of the radiation balance at the top of the atmosphere. Formally the difference between the two equals the net heat flux through the earth's surface. Over land the estimated total energy source should be nearly equal

to the radiation balance. The best agreement is found in July 1979 over the northern hemisphere middle latitudes, where monthly averages over large land-areas agree to within 10 W/m^2. In February, the residual is systematically too large by 20-40 W/m^2 over the same regions. Elsewhere, differences of up to 60 W/m^2 occur for corresponding averages. Over low latitude continents, the residuals are generally too small over convectively active regions and too large over subsidence regions. Over the oceans the difference between the net radiation and the total energy source compares favourably with available estimates of the climatological heat flux through the surface. The same is true for the residual source of latent energy and the fresh water flux through the surface.

2902 Economics and Sociology

Refer also to citation(s) 398, 771, 788, 801, 875, 1769

751 (CONF-920828–10) **Future directions: Integrated resource planning.** Bauer, D.C. (Oak Ridge National Lab., TN (United States)); Eto, J. Oak Ridge National Lab., TN (United States). [1992]. 26p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From American Council for an Energy-Efficient Economy (ACEEE) summer study on energy efficiency in buildings; Pacific Grove, CA (United States); 30 Aug - 5 sep 1992. Order Number DE92040867. Source: OSTI; NTIS; GPO Dep.

Integrated resource planning or ERP is the process for integrating supply- and demand-side resources to provide energy services at a cost that balances the interests of all stakeholders. It now is the resource planning process used by electric utilities in over 30 states. The goals of IRP have evolved from least cost planning and encouragement of demand-side management to broader, more complex issues including core competitive business activity, risk management and sharing, accounting for externalities, and fuel switching between gas and electricity. IRP processes are being extended to other interior regions of the country, to non-investor owned utilities, and to regional (rather than individual utility) planning bases, and to other fuels (natural gas). The comprehensive, multi-valued, and public reasoning characteristics of IRP could be extended to applications beyond energy, e.g., transportation, surface water management, and health care in ways suggested in the paper.

752 (NEI-NO–291) **Petroleum taxation under uncertainty - contingent claims: Analysis with an application to Norway.** Lund, D. Oslo Univ. (Norway). Sosialoekonomisk Inst. 1990 18p. Order Number DE93721671. Source: OSTI; NTIS; INIS.

A workable method for the analysis of incentive effects of petroleum taxes under uncertainty is presented. The main advantage of the method is that it concludes with a single number for the after-tax value of any development plan, and thus allows for a quantification of incentive effects for any given description of production possibilities. It is, however, not possible to describe tax effects under uncertainty by simple magnitudes independent of production possibilities, such as wedges in rates of return. The theoretical basis is the contingent claims analysis from finance theory, which is applicable in particular to companies that are owned by well-diversified shareholders. It is not obvious that the tax authorities of poorly diversified countries should value uncertain income streams by the same method. The Norwegian petroleum taxation is shown to have strongly distortionary effects compared to a no-tax situation or a cash flow tax. These distortions were reduced by the tax changes that followed the 1986 decreases in crude oil prices. A weakness of the model of the Norwegian system is that an exactly optimal financial policy for the company has not been found. 30 refs., 2 figs., 3 tabs.

2903 Environment, Health, and Safety

Refer also to citation(s) 750, 781, 789, 876, 877, 889, 930, 1473, 1504, 1538, 1539, 1550, 1554, 1638, 1650

753 (ANL/RP–76696) **Production of a legislative environmental impact statement for the Chemical Weapons Convention: Background, format, and data requirements.** Lerner, K.; Tanzman, E.A. Argonne National Lab., IL (United States). 13 Jul 1992. 8p. Sponsored by Defense Nuclear Agency, Washington, DC (United States). DOE Contract W-31109-ENG-38. (DNA–001-90-C-0177). Order Number DE92040758. Source: OSTI; NTIS; GPO Dep.

This background paper addresses requirements for drafting a legislative environmental impact statement (LEIS) to accompany United States Senate approval of the proposed Chemical Weapons Convention (CWC).[1] It provides a brief description of the background and regulatory requirements of the National Environmental Policy Act of 1969 (NEPA)[2] and how those requirements would apply to the legislative process of approving and implementing the CWC. It also outlines the types of information typically presented in an EIS, and briefly explores the scope of issues to be addressed and data that would be needed in order to produce an LEIS for the CWC.

754 (CEA-CONF–10988) **Have hydraulic and nuclear power to be charged for greenhouse effect.** Charmant, A.; Ladoux, N.; Vielle, M. CEA, 75 - Paris (France). Mar 1992. 12p. (CONF-920532–: 15. annual conference of the International Association for Energy Economics, Tours (France), 18-20 May 1992). Order Number DE93721050. Source: OSTI; NTIS (US Sales Only); INIS.

Despite scientific uncertainties, there is a general agreement to ensure environmentally sound economic development, even if associated risks are in the very long term. To decrease carbon dioxide emissions, setting a carbon tax is often mentioned. Yet, some voices are claiming that such a tax, if decided, should be extended to all energy sources. The EEC project recommends to mix those two taxes but the French industry minister declared: We are trying to control the emissions of carbon dioxide by taxing all energy sources. This is like trying to combat alcoholism by also taxing orange juice. Beyond politician argumentation, the question of economic efficiency of each tax could be examined. That is, which is the best way, energy or carbon tax, to reach a CO_2 emission reduction target at least cost. Focusing on French economy through the Melodie model, we try to give some assessments about this question. By the year 2000, efficiencies of the two taxes are close, although energy tax is a bit more expensive. On the other hand carbon tax is unambiguously more efficient in the long run, let us say by 2010. The decision to stabilize carbon dioxide emission by 2000 at the 1990 level was adopted by the EEC Energy/Environment Committee on November the 20 th, 1990. As results, 2000 become, almost thoughtlessly, a preference target data. Will the 'no-regret' policy become the 'short-sighted' one.

755 (CONF-891098–15) **Potentials to transfer the US NEPA experience to developing countries.** Wilbanks, T.J.; Hunsaker, D.B. Jr.; Petrich, C.H.; Wright, S.B. Oak Ridge National Lab., TN (United States). [1989]. 32p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From The scientific challenges of NEPA: future directions based on 20 years of experience; Knoxville, TN (United States); 24-27 Oct 1989. Order Number DE92040705. Source: OSTI; NTIS; GPO Dep.

The US National Environmental Policy Act (NEPA) of 1969 has been important as a learning experience for the United States, but it has also served as a model for the rest of the world. In particular, other counties which benefit form US foreign aid have found NEPA concerns to be of growing importance in the 1980s and multinational bodies such as The World Bank have increasingly suggested US standards and practices as guidelines to countries without well-defined environmental policies of their own. With environmental protection becoming a dominant issue in development assistance, it is timely to assess the relevance of the US experience to developing countries. Other outgrowths of the NEPA process in the United States may be less appropriate to the conditions that exist in many developing countries. Examples might include standards for certain emissions, standards for impact analysis, the size and complexity of impact assessment documents, and mechanisms for public involvement. In these kinds of connections, the US NEPA experience is already becoming an issue in the expanding dialogue about global environmental change, Considered in the light of the experience of other advanced countries, such as West Germany and Great Britain, and in the light of differing circumstances of

less-developed countries, such as urgent needs for job creation and shortages of technical capabilities, the US experience has the potential to be transformed from what now appears too often to be a rigid straight-jacket to what can be a rich, robust body of lessons learned. In the process, an enhanced transfer of US professional experience and monitoring and control technologies can contribute to our competitiveness in the world economy and an acceleration of environmental management improvements in developing countries.

756 (GESAMP–48) **Global changes and the air-sea exchange of chemicals: Reports and studies. No. 48.** GESAMP-IMO/FAO/UNESCO/WMO/WHO/IAEA/UN/UNEP Joint Group of Experts on the Scientific Aspects of Marine Pollution. World Meteorological Organization, Geneva (Switzerland). 1991. 71p. Order Number DE93605636. Source: OSTI; NTIS (US Sales Only); INIS.

Present and future changes to global environment have implications for marine pollution and for air-sea exchange of both anthropogenic and natural substances. This report addresses 3 issues related to potential impact of global change on air-sea exchange of chemicals: Global change and air-sea transfer of nutrients nitrogen and iron. Global change and air-sea exchange of gases. Oceanic responses to radiative and oxidative changes in atmosphere. Deposition of atmospheric anthropogenic nitrogen has probably increased bio- productivity in coastal regions along continental margins. Atmospheric deposition of new nitrogen may also have increased productivity somewhat in mid-ocean regions. Projected future increases of N oxide emissions from Asia, Africa and South America will increase the rate of deposition of oxidized nitrogen to central North Pacific, equatorial Atlantic, and equatorial and central South Indian Oceans. Atmospheric iron may be an important nutrient in certain open regions. Future changes will likely occur from changed aridity and wind speed as a result of climate change. The most important future effects on surface ocean p_{CO2} will likely be caused by changes in ocean circulation. The pH of ocean would decrease by ≈0.3 units for a doubling of p_{CO2}, reducing the capacity of the ocean to take up CO_2. There is evidence that dimethyl sulfide from ocean is a source of cloud condensation nuclei and thus a factor controlling cloud albedo. By 2060 in the southern hemisphere reduction in total column stratospheric ozone from recent levels could reach 2 to 5% in the tropics, 10% at mid latitudes, and over 20% at 60 deg C. S. Increases in ground-level effective UV-B radiation could also reach 5%, 26% and 66%, at low, mid, and high latitudes in southern hemisphere. Changes in photochemical processes in the surface waters of the ocean could also happen.

757 (INIS-mf–13360) **IOC-CEC-ICES-WMO-ICSU ocean climate data workshop.** Workshop report. United Nations Educational, Scientific and Cultural Organization (UNESCO), 75 - Paris (France). Intergovernmental Oceanographic Commission (IOC). 1992. 32p. (CONF-9202130–: Ocean climate data workshop, Greenbelt, MD (United States), 18 Feb 1992). Order Number DE93603707. Source: OSTI; NTIS (US Sales Only); INIS.

The Ocean Climate Data Workshop organized in Greenbelt, Maryland, USA, on 18-21 February 1992 was attended by more than 100 people from 18 countries. The heart of the programme were three groupings of "Case Studies" in which scientists and data managers summarized findings on recent research projects and discussed data management aspects including recommendations for improvements needed for the future. Case studies were grouped into the following sessions: Monitoring Changes in the Ocean and Atmosphere; Data Archeology (Historical Data); Effect of Change in the Ocean and on the Life Cycle (Emphasis on Chemical and Biological Observations). A full range of technical matters associated with the collection and dissemination of data and meta-date were discussed. The topics covered were the problems associated with the increasing size of data sets like techniques for storage and retrieval of these data; increasing complexity of data (new data types especially in Chemistry and Biology, growing importance of meta-data and problems associated with the cost, formatting, storage and retrieval of this information); and for correlation of data sets across disciplinary lines, for instance development of a common geo-reference system.

758 (INIS-mf–13370) **IOC-UNEP regional workshop to review priorities for marine pollution monitoring, research, control and abatement in the wider Caribbean: Pt. 1 report, Pt. 2 marine pollution assessment and control programme for the wider Caribbean region - CEPPOL.** IOC workshop report. United Nations Educational, Scientific and Cultural Organization (UNESCO), 75 - Paris (France). Intergovernmental Oceanographic Commission (IOC). 1989. 114p. (CONF-8908295–: IOC-UNEP regional workshop to review priorities for marine pollution monitoring research, control and abatement in the wider Caribbean, San Jose (Costa Rica), 24 Aug 1989). Order Number DE93605628. Source: OSTI; NTIS (US Sales Only); INIS.

Also available in Russian and Spanish from IOC-UNESCO, Paris, France.

The IOC-UNEP Regional Workshop to Review Priorities for Marine Pollution Monitoring, Research, Control and Abatement in the Wider Caribbean Region (San Jose, 24-30 August 1989) examined a possible general framework for a regionally co-ordinated comprehensive joint IOC/UNEP programme for marine pollution assessment and control in the Wider Caribbean region (CEPPOL). The overall objective of CEPPOL is to establish a regionally co-ordinated comprehensive joint IOC/UNEP Marine Pollution Assessment and Control Programme catering to the immediate and long-term requirements of the Cartagena Convention as well as the requirements of the member States of IOCARIBE. The specific objectives of the programmes are: (i) To organize and carry out a regionally co-ordinated marine pollution monitoring and research programme concentrating on contaminants and pollutants affecting the quality of the marine and coastal environment, as well as the human health in the Wider Caribbean and to interpret/assess the results of the programme as part of the scientific basis for the region; (ii) To generate information on the sources, levels, amounts, trends and effects of marine pollution within the Wider Caribbean region as an additional component of the scientific basis upon which the formulation of proposals for preventive and remedial actions can be based; (iii) To formulate proposals for technical, administrative and legal pollution control, abatement, and preventive measures and to assist the Governments in the region in implementing and evaluating their effectiveness; and (iv) To strengthen and , when necessary, to develop/establish the capabilities of national institutions to carry out marine pollution monitoring and research, as well as to formulate and apply pollution control and abatement measures.

759 (NEDO-ITE–9101) **Survey of an evaluation method for CO_2 reduction technology in the chemical related industry field.** New Energy and Industrial Technology Development Organization, Tokyo (Japan). Mar 1992. 203p. (In Japanese). Sponsored by New Energy and Industrial Technology Development Organization, Tokyo (Japan). Order Number DE93723970. Source: OSTI; NTIS.

The method similar to the inter-industry relations analysis is proposed to establish the method for making a quantitative evaluation of the effects of various technologies for CO_2 emission reduction measures in the chemical related industry field. In the production process, a new concept, a cumulative CO_2 emission unit requirement (ϕ) is made an evaluation index. In each unit which composes the process, an in/out relationship of materials is expressed linearly, and it is supposed that the connection state between units is already known, and ϕ for raw materials and energy to be used and necessary expenses including equipment and personnel are given as initial conditions. Then, ϕ per product unit quantity can be introduced as a solution of the multidimensional simultaneous equation by the method similar to the inter-industry relations analysis. As basic data, the present situation of CO_2 emission and flow of materials/energy in the following three chemical related industries are studied: chemical/petrochemical, oil refining and food/pharmaceutical. As a result of trially applying the method to typical plants in the above-mentioned three industries in terms of the present technology and improved technology, validity of this evaluation method is confirmed and ϕ of each product can be calculated. 52 refs., 60 figs., 70 tabs.

760 (NEDO-ITE–9107) **Survey on fixation and utilization of carbon dioxide. (2).** New Energy and Industrial Technology Development Organization, Tokyo (Japan). Mar 1992. 223p. (In Japanese). Sponsored by New Energy and Industrial Technology

Development Organization, Tokyo (Japan). Order Number DE93723972. Source: OSTI; NTIS.

The paper surveys CO_2 fixation technology by which CO_2 is separated and recovered from stationary pollutant sources and converted to useful compounds by hydrogenation. The technology considers separation/concentration of CO_2, catalytic hydrogenation for methanol synthesis and optimization of the total system for hydrogen technology. The operative range of a separation/recovery absorption method and the improved type are proposed. For a zeolite PSA adsorption method, the two-step concentration process is suitable in terms of recovery and purity. Hollow fiber module membrane separation takes a little energy, but is difficult using the one-stage separation process and needs the two-stage separation process. The combined process in which the membrane separation process is for the front step and the adsorption method for the back step is worth studying in terms of recovery and purity. Hydrogenation for methanol synthesis is a fully practicable technique. Water electrolysis is indispensable for hydrogen production so far, but the subject is energy utilization in which no CO_2 is emitted. Studies are needed also on overseas hydroelectric power sources and biological hydrogen production such as chemical water decomposition by solar energy. Assuming that methanol is to be synthesized in Japan or overseas, profits and losses in each case of domestic or foreign synthesis of methanol are discussed, including production, storage and transportation problems. 119 refs., 100 figs., 71 tabs.

761 (NEI-DK–959) **Low electricity Europe - sustainable options.** Noergaard, J.S.; Viegand, J. Danmarks Tekniske Hoejskole, Lyngby (Denmark). Fysisk Lab. 3. Apr 1992 120p. Order Number DE93721472. Source: OSTI; NTIS.

The initiative for the study was taken by a small group of scientists etc. who were worried about the use of nuclear and fossil fuels and at the same time were aware of the potentials for a more efficient use of electricity. They were also interested in a new European approach to electricity planning. The study includes 15 West European countries, and the aim is environmental sustainability. It is emphasized how little electricity is really needed in the future. Supply options are briefly described. Data on possibilities for increasing efficiency for various end uses, such as lighting etc. are summarized. It is stated that factors which determine future electricity consumption are population, economic activity, standard of living and technological efficiency. It is concluded that over the next few decades, electricity consumption in Western Europe can be substantially reduced through implementation of a more efficient end-use technology. These technical savings will have a tendency to be eaten up by new demands if we continue to pursue a policy of economic growth. Only if we accept an economic saturation, it is claimed, can we attain a stable consumption of electricity which will be 45% below what it is now. This would make it possible, it is suggested, to phase out nuclear as well as coal power plants, and in general to achieve a sustainable electricity supply system. The methodology used makes it possible to analyze and present effects of better technologies, changes in economic structure etc. (AB) (87 refs.).

762 (NEI-NO–275) **Energy use and environmental consequences in the industrial sector.** Finden, P. (Institutt for Energiteknikk, Kjeller (NO)). Norsk Inst. for Luftforskning, Lillestroem (Norway); Institutt for Energiteknikk, Kjeller (Norway). 1990 20p. (In Norwegian). (CONF-9010522–2: Energy- and environmental perspectives for Norway, Kjeller (Norway), 11 Oct 1990). Order Number DE93721662. Source: OSTI; NTIS.

The present seminar paper evaluates the use of energy and the environmental consequences thereof in the industrial sector in Norway. The energy consumption varies more than 20% from one year to the next caused by fluctuations in the market or climatic variations. Data being analysed and presented concern the emitted volumes of climate-affecting gases from combustion sources, the total energy conservation potential of different energy carriers, and energy saving potentials as a function of investments and measures. 4 figs., 7 tabs.

763 (NEI-NO–276) **Energy use and environmental consequences: Building sector.** Skaaret, E. (Norges Byggforskningsinstitutt, Oslo (NO)). Norsk Inst. for Luftforskning, Lillestroem (Norway); Institutt for Energiteknikk, Kjeller (Norway). 1990 9p. (In Norwegian). (CONF-9010522–1: Energy- and environmental perspectives for Norway, Kjeller (Norway), 11 Oct 1990). Order Number DE93721663. Source: OSTI; NTIS.

The present seminar paper deals with the total energy use and the environmental consequences of energy conversion and the physical/chemical conditions in connection with the production and processing of materials in the building sector in Norway. Different energy conservation measures by utilizing new technologies in the existing building mass together with the use of new types of building materials in new designed buildings to satisfy the demands of building regulations are discussed. 4 figs.

764 (NEI-NO–288) **The oil market and international agreements on CO_2 emissions.** Berger, K. (Statistisk Sentralbyraa, Oslo (NO)); Fimreite, Oe.; Golombek, R.; Hoel, M. Oslo Univ. (Norway). Sosialoekonomisk Inst. 1991 32p. Order Number DE93721668. Source: OSTI; NTIS; INIS.

In order to avoid a relatively large risk of dramatic adverse climatic changes during the next century, greenhouse gas emissions must be reduced significantly relative to present emissions. CO_2 is the most important greenhouse gas, so any international agreement will certainly cover CO_2 emissions. Any international agreement to reduce emissions of CO_2 is going to have a significant impact on the markets for fossil fuels. The analysis shows that is not only the amount of CO_2 emissions permitted in an agreement which matters for fossil fuel prices, but also the type of agreement. Two obvious forms of agreements, which under certain assumptions both are cost efficient, are (a) tradeable emission permits, and (b) an international CO_2 tax. If the fossil fuel markets were perfectly competitive, these two types of agreements would have the same effect on the producer price of fossil fuels. However, fossil fuel markets are not completely competitive. It is shown that, under imperfect competition, direct regulation of the "tradeable quotas" type tends to imply higher producer prices than an international CO_2 tax giving the same total CO_2 emissions. A numerical illustration of the oil market indicates that the difference in producer prices for the two types of CO_2 agreements is quite significant. 6 refs., 2 figs., 1 tab.

765 (NEI-NO–289) **The valuation of environmental goods in Norway: A contingent valuation study with multiple bias testing.** Strand, J.; Taraldset, A. Oslo Univ. (Norway). Sosialoekonomisk Inst. 1991 45p. Order Number DE93721669. Source: OSTI; NTIS.

We report on a study of contingent valuation of reduction in air pollution, and of a broader set of six environmental issues, among a population sample in Oslo. We derive an estimate of the extent of upward bias due to "mental accouting" in the expressed valuation of the air pollution issue, in two steps: (1) by comparing valuation of air pollution alone, with the same when the other issues at the same time are to be dealt with; and (2) by deriving the implicit valuation of the air pollution issue from the ranking of issues, and total valuation of all six issues. We find that expressed valuation of air pollution reductions are 3-4 times as high as the "true" values, and argue that this discrepancy is mainly due to mental account biases. We also test for strategic, starting point, information and interviewer biases, which are all present and, with the exception of the information bias, all in the expected directions. 9 refs., 4 tabs.

766 (NEI-NO–290) **Tradable emission rights and strategic interaction.** Fehr, N.-H.M. von der. Oslo Univ. (Norway). Sosialoekonomisk Inst. 1991 38p. Order Number DE93721670. Source: OSTI; NTIS.

The use of economic instruments in the form of tradable emission rights, or pollution permits, have become increasingly popular as a means of implementing reductions in environmental damage. In the report it is shown that emission rights may create an instrument by which oligopolistic firms may try and influence their rivals' behavior. It is also shown how such strategic manipulation of the permit market may have anti-competitive, and, moreover negative welfare effects, in output markets. An alternative to emsission rights which do not have such strategic consequences, is emission charges. Emission charges have generally been criticised on the grounds that they require substantial information to implement given levels of environmental standards, whereas tradable emission rights can achieve such goals in a much more direct way without the need for

any information on demand and supply technologies in the regulated industries. The results of this paper provide additional support to the conclusion that against this argument should be set the possible anti-competitive effects of pollution permits. 16 refs., 3 figs.

767 (NINA-R–029) **Responses of climate change on natural terrestrial ecosystems in Norway.** Holten, J.I.; Carey, P.D. Norsk Inst. for Naturforskning, Trondheim (Norway). 1992. 59p. Order Number DE93721672. Source: OSTI; NTIS.

This report discusses possible effects of climatic and hydrological changes on Norwegian terrestrial ecosystems. Norway is tentatively subdivided into four ecoclimatic sensitivity regions, based on Norwegian climatic and hydrological scenarios. The most sensitive region is suggested to be alpine ecosystems including mountain forests (region I). The ecologically most significant factor for the changes in region I is snow cover and hydrology. The flat river valley bottom region (region IV) is suggested to have the same sensitivity as region I. Melting of permafrost can lead to substantial changes in Svalbard's ecosystems. In the forest region (region II) Scots pine may be favored on the expense of Norway spruce. Dutch elm disease may reduce or even eradicate most elm populations in region II. Natural and anthropogenic migration barriers will delay the invasion of temperature and oceanic plant species. One may expect enhanched biodiversity in the hemiboreal and southern boreal zone in South Norway, whereas Central Norway may have lowered biodiversity in the long run. From existing lists of rare and threatened plants, 12 species are suggested to be threatened (directly or indirectly) by climate change. A non-linear type of ecosystem changes is expected in most ecosystems, triggered by a higher frequency and intensity of extreme weather events. The assessment of critical rates and levels of climatic change and tolerance limits for species, will depend on much better knowledge on ecosystem dynamics and processes, especially demographic processes. The ecotonal boundary method is recommended both for research and monitoring. 59 refs., 14 figs., 2 tabs.

768 (SA-PUB–9/89-Vol.2, pp. 275-289) **The impact of climate on the operation of the French electric system.** Duband, D. (Electricite de France (EDF), 38 - Grenoble (France)); Rabut, P.; Clavel, P.; Leveugle, J. Academy of Finland, Helsinki (Finland). 1989. (CONF-8909491–Vol.2: Conference on climate and water, Helsinki (Finland), 11-15 Sep 1989). In *Conference on climate and water: Volume 2.* 393p. Order Number DE93721621. Source: OSTI; NTIS.

The paper describes how EDF incorporates climatic parameters in solving three particular problems: water resource management and streamflow forecasting, energy consumption forecasting and the joint operation of a mixed system including hydroelectric and thermal power plants under highly uncertain conditions for the future. Several perspectives are discussed on the sensitivity of these approaches to climatic variations.

769 (SNV–4033) **New technology for refrigeration and heating plants.** Joensson, U. (A.C. Nielsen Company AB, Kista (SE)); Stenberg, P.; Pettersson, A.H.; Rizell, P.O. Swedish Environmental Protection Agency, Solna (Sweden). Mar 1992. 48p. Order Number DE93721673. Source: OSTI; NTIS.

Also available in Swedish as SNV–4020.

The report is an account of a project which aimed at making a survey of the technical development of refrigeration and heating pump plants against the background of international and national plans to phase out the use of CFC and HCFC refrigerants. The report is not intended to give full coverage of the market: instead, its purpose is to give examples of technology which allow for reductions in the use of CFC and HCFC refrigerants. The account describes the technical development position in the autumn of 1991. The consultancy is responsible for the contents of the report. (au).

770 (YMP-R–87/1990) **Reponsiveness of Finnish science and technology institutions to environmental change.** Talsi, T. (ed.). Ministry of the Environment, Helsinki (Finland). Environmental Protection Dept. 1990. 58p. Order Number DE93711141. Source: OSTI; NTIS.

This report was compiled as the Finnish contribution to the OECD/CSTP project 'Responsiveness of Science and Technology Institutions to Environmental Change'. The report focusses on the general development of Finnish environmental policies during 1960-1990 and the impact of environmental concerns on policy planning in other sectors of society during the 1980s. The section dealing with the development of science and technology policies outlines how the changes in environmental policies and the growing importance attached to environmental protection has been reflected in the Finnish science and technology institutions (policies, funding and funded institutions) and their objectives. The report presents two examply of environment related research, namely, acidification research and RAD related to forest industry effluents.

2904 Energy Resources

Refer also to citation(s) 54, 768, 789, 1507, 1529, 1530, 1531, 1532, 1533

771 (IFP–39657) **Energy demand modelling: pointing out alternative energy sources. The example of industry in OECD countries.** Renou, P. Institut Francais du Petrole (IFP), 92 - Rueil-Malmaison (France). 19 Feb 1992. 465p. (In French). Order Number DE93720904. Source: OSTI; NTIS (US Sales Only); INIS.

This thesis studies energy demand and alternative energy sources in OECD countries. In the first part, the principal models usually used for energy demand modelling. In the second part, the author studies the flexible functional forms (translog, generalized Leontief, generalized quadratic, Fourier) to obtain an estimation of the production function. In the third part, several examples are given, chosen in seven countries (Usa, Japan, Federal Republic of Germany, France, United Kingdom, Italy, Canada). Energy systems analysis in these countries, can help to choose models and gives informations on alternative energies. 246 refs., 24 figs., 27 tabs.

772 (NEI-NO–283) **Energy resource planning: A conceptual study of a multiobjective problem.** Johansen, S.E. Trondheim Univ. (Norway). Norges Tekniske Hoegskole. 1992 248p. Order Number DE93721639. Source: OSTI; NTIS.

This report is a conceptual study of the Energy Resource Planning (ERP) task as a multiobjective planning problem. Traditionally, the ERP task is approached with extensive application of economic and technical/process-oriented methods of analysis. Cost minimization and feasibility constraints usually serve as a basis on which to make resource selections, thus, in principle solving the ERP task as a constrained, single criterion, optimization problem. This study recognizes and emphasizes the ERP task as being a multiobjective planning task. For example, that the ERP task involves multiple planning objectives, of which many are intangible, noncommensurable and conflicting. The study performs an extended formulation of the ERP task, and emphasises two different categories of solution approaches, distinguished by their conceptually different treatment of planning objectives, i.e. the quantitative approach and the qualitative approach. The quantitative approach involves the value achievement of relevant planning objectives in representative monetary terms (costs) as function(s) of resource alternatives. A preferred resource plan is then identified as the least cost plan, in the multiobjective sense. Thus, the monetized values represent a basis on which to select the best compromise plan. An extensive discussion of environmental costs clearly illustrates complexities and applicability of the quantitative approach to the ERP task. The qualitative approach recognizes achievement of all relevant planning objectives as not possible to appropriately value in monetary terms. Rather, the range of resource choice and trade-offs between objectives is identified and communicated to decisionmaker(s). A best compromise resource plan is selected based implicitly on decisionmaker(s) preferences and value tradeoffs. 98 refs., 42 figs., 5 tabs.

773 (SA-PUB–9/89-Vol.2, pp. 383-393) **Study of water resources systems operation taking account of climatic changes.** Shnaidman, V.M. (USSR Academy of Sciences, Moscow (USSR). Water Problems Institute). Academy of Finland, Helsinki (Finland). 1989. (CONF-8909491–Vol.2: Conference on climate and water, Helsinki (Finland), 11-15 Sep 1989). In *Conference on climate and water: Volume 2.* 393p. Order Number DE93721621. Source: OSTI; NTIS.

A method, based on the investigation of water resources system sensitivity using a simulation model is suggested to estimate the system response to man-induced climatic changes. The paper discusses the state-of-the-art of the problem, the general scheme of its investigation, the way of developing the simulation model and methods of simulation experiments for irrigational water resources systems.

2905 Research, Development, Demonstration, and Commercialization

Refer also to citation(s) 391, 400, 744, 745, 746, 747, 748, 807, 846

774 (DOE/ER/75682–1) **Kansas energy 2000: Progress report, September 30, 1991–September 29, 1992.** Kansas State Univ., Manhattan, KS (United States). Sep 1992. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-91ER75682. Order Number DE93001484. Source: OSTI; NTIS; GPO Dep.

The state of Kansas during the year 30 September 1991 to 29 September 1992 has accomplished a variety of objectives in its Department of Energy/Experimental Program to Stimulate Competitive Research (DOE/EPSCoR) planning process. As a new EPSCoR state, it has had to develop its management organization. This has been accomplished, with the result that EPSCoR is under the aegis of a body charged with planning the economic development of the state. An inventory of research assets and needs was performed and a report of the results of that inventory was produced. A DOE/EPSCoR Steering Committee was formed. This working committee met at least twice a month in the spring of 1992 doing strategic planning as well as giving guidance for the traineeship proposal recently funded. This committee identified certain priority areas for development by the DOE/EPSCOR project: Environment, Geology, Materials Science, Nuclear Science and Engineering, Alternate Sources and Efficiencies in Power Generation, Basic Sciences, and the Educational Pipeline. A call for proposals from state research groups has resulted in thirty-nine proposals in these priority areas. The best of them will then be selected for inclusion in the state's implementation plan and proposal.

775 (LBL–32385) **World energy: Building a sustainable future.** Schipper, L.; Meyers, S. Lawrence Berkeley Lab., CA (United States). Apr 1992. 118p. Sponsored by Stockholm Environment Inst. (Sweden). DOE Contract AC03-76SF00098. Order Number DE93001598. Source: OSTI; NTIS; GPO Dep.

As the 20th century draws to a close, both individual countries and the world community face challenging problems related to the supply and use energy. These include local and regional environmental impacts, the prospect of global climate and sea level change associated with the greenhouse effect, and threats to international relations in connection with oil supply or nuclear proliferation. For developing countries, the financial cost of providing energy to provide basic needs and fuel economic development pose an additional burden. To assess the magnitude of future problems and the potential effectiveness of response strategies, it is important to understand how and why energy use has changed in the post and where it is heading. This requires study of the activities for which energy is used, and of how people and technology interact to provide the energy services that are desired. The authors and their colleagues have analyzed trends in energy use by sector for most of the world's major energy-consuming countries. The approach we use considers three key elements in each sector: the level of activity, structural change, and energy intensity, which expresses the amount of energy used for various activities. At a disaggregated level, energy intensity is indicative of energy efficiency. But other factors besides technical efficiency also shape intensity.

776 (YMP-MUIST–5/1991) **Development programme for air pollution control research 1991-1995.** Savolainen, K.; Juntto, S. Ministry of the Environment, Helsinki (Finland). Environmental Protection Dept. 1991. 45p. (In Finnish). Order Number DE93711148. Source: OSTI; NTIS.

The programme comprises the most important air pollution control research entities in the years 1991 - 1995. It also contains the required ancillary functions: research coordination and follow-up, post-graduate education, and increased utilization of research results. The present programme discusses the implementation of the first research programme for air quality management 1986 - 1990 and recent air pollution research. The discussion of research needs is based on the air pollution control cycle. Research projects are not listed; instead, the programme presents major entities without giving priorities with regard to importance or extent. In every field there is a presentation of a few important our urgent research projects. The research fields requiring the main additional input are air chemistry and environmental health. Economic research on air pollution should be developed as part of environmental economics.

2906 Nuclear Energy

Refer also to citation(s) 230, 269

777 (CEA-CONF–10966) **Perspectives of nuclear Energy in Europe.** Naudet, G. CEA, 75 - Paris (France). 1992. 6p. (In French). (CONF-9204204–: The Kangaroo Group Energy Conference, Paris (France), 3-4 Apr 1992). Order Number DE93721209. Source: OSTI; NTIS (US Sales Only); INIS.

In this paper the author evokes the contribution of nuclear energy in the European Community energy provisioning for the year 2010.

778 (INIS-mf–13359) **A framework for discussion on the environment.** Department of the Environment, Ottawa, ON (Canada). 1990 70p. (In English, French). Order Number DE93604021. Source: OSTI; NTIS (US Sales Only); INIS.

This document outlines the measures the government of Canada proposes to take in order to make Canada the world's most environmentally friendly country. The reflection and discussion that this document generates will influence the order of priority in the final action plan.

779 (INIS-mf–13364) **Safety culture: Report by the International Nuclear Safety Advisory Group.** Bezpecnost Jademych Zarizeni. Beninson, D. (and others); Birkhofer, A.; Chatterjee, S.K.; Domaratzki, Z; Edmontson, B.; Gonzalez-Gomez, E.; Hoehn, J.; Kouts, H.J.C.; Lepecki, W.; Sato, K. Ceskoslovenska Komise pro Atomovou Energii, Prague (Czechoslovakia). 1992 24p. Translation of a report by the International Nuclear Safety Advisory Group; IAEA Safety Series No. 75-INSAG-4. (In Czech). Order Number DE93605958. Source: OSTI; NTIS (US Sales Only); INIS.

The response to a previous publication by the International Nuclear Safety Advisory Group (INSAG) indicated a broad international interest in expanding the concept of Safety Culture in such a way that its effectiveness in particular cases may be judged. This report responds to that need. In its manifestation, Safety Culture has two major components: the framework determined by organizational policy and by managerial action, and the response of individuals in working within and benefiting by the framework. 1 fig.

780 (KAERI/RR–1051/91) **A study on enhancing the utilization of nuclear power in Korea: With reference to the role of nuclear in solving the global warming problem and to the nuclear export control system.** Choi, Young Myung (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Han, Do Hee; Lee, Byung Wook; Lee, Kwang Seok; Lee, Jae Sung; Choi, Young Lok; Jo, Se Hyun; Lee, Han Myung; Won, Byung Chool; Park, Sung Gi. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Jan 1992. 101p. (In Korean). Order Number DE93605590. Source: OSTI; NTIS (US Sales Only); INIS.

As the world recognizes the global warming problem as an important issue it has to solve, nuclear power is being considered as a way to solve the problem. This study reviews (1) what the global warming problem is, (2) why the problem occurs, and (3) how the problem can be solved. This study also review international effort to solve the problem in terms of intergovernmental negotiation on climate change and its effect on Korea. This study discusses the role of nuclear power in solving the problem, contrasting the argument of those who object to the use of nuclear power. With the argument of those who agree to the use of nuclear power. This study reviews and analyzes recent changes in the international nuclear society; especially fortification of special inspection and safeguards by the IAEA, and attempt to append dual purpose items to London

Guidelines. This study reviews the history of the Nuclear Non-Proliferation Act in the USA in terms of its background and role. This study discusses the Nuclear proliferation Prevention Act which was proposed recently in the USA. This study suggests policies Korea should take to respond to the changes effectively. (Author).

2907 Transport and Storage

Refer also to citation(s) 146

781 (NEDO-P–9107) **Study on the clean energy network sytem for the global environment.** New Energy and Industrial Technology Development Organization, Tokyo (Japan). Mar 1992. 169p. (In Japanese). Sponsored by New Energy and Industrial Technology Development Organization, Tokyo (Japan). Order Number DE93723962. Source: OSTI; NTIS.

The paper confirms the concept of the global energy network system and also studies practical applicability of a clean energy transportation system by studying energy balance, prediction survey of utilization forms and field survey of overseas cases. This system produces hydrogen by water electrolysis using hydroelectric/photovoltaic power generation, etc. in the area which has rich renewable energy, converts it to hydrogen derivatives such as liquefied hydrogen or methanol in consideration of transportability and transports them to the areas where they are used as extensive energy sources for power generation, transportation and town gas. To make a quantitative evaluation of this system, conducted are estimation of suppliable hydroelectric resource, trial calculation of energy balance ratio of the system study of CO_2 reduction effect and prediction of the amount of hydrogen energy to be introduced. Moreover, validity of the system can be evaluated in comparison of economy between the Euro Quebec project and this system in the overseas field survey. 57 refs., 36 figs., 39 tabs.

2910 Conservation

Refer also to citation(s) 800, 859, 860

782 (ANL/CP–77472) **Industrial energy conservation, an overview.** Schertz, W.W. Argonne National Lab., IL (United States). [1992]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9209160–15: International symposium on energy, environment and information management, Argonne, IL (United States), 15-18 Sep 1992). Order Number DE92041086. Source: OSTI; NTIS; INIS; GPO Dep.

Short communication. INDUSTRY/energy conservation; INDUSTRY; TECHNOLOGY IMPACTS; PETROLEUM INDUSTRY; CHEMICAL INDUSTRY; METAL INDUSTRY; PAPER INDUSTRY; FOOD INDUSTRY; TEXTILE INDUSTRY; AGRICULTURE; MANUFACTURING; MINING; CONSTRUCTION; TRANSPORTATION SECTOR

783 (LBL–32214) **Persistence of energy savings: What do we know and how can it be ensured?.** Vine, E. Lawrence Berkeley Lab., CA (United States). May 1992. 23p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-920828–14: American Council for an Energy-Efficient Economy (ACEEE) summer study on energy efficiency in buildings, Pacific Grove, CA (United States), 30 Aug - 5 sep 1992). Order Number DE92041188. Source: OSTI; NTIS; GPO Dep.

This paper presents a conceptual framework for analyzing persistence of energy savings, summarizes the limited experience of what we know about persistence, provides guidance for conducting retrospective and prospective persistence studies, and suggests strategies for ensuring persistence. Because this area of research is in its infancy, unequivocal conclusions about persistence would be premature. Accordingly, this paper provides guidance for both conducting research in this area and developing policies and mechanisms to help ensure the persistence of energy savings.

784 (LBL-PUB–5330) **The California Institute for Energy Efficiency multiyear research plan, 1992–1996.** Lawrence Berkeley Lab., CA (United States). Jul 1992. 154p. Sponsored by USDOE, Washington, DC (United States); California Inst. for Energy Efficiency, Berkeley, CA (United States). DOE Contract AC03-76SF00098. Order Number DE93000577. Source: OSTI; NTIS; GPO Dep.

The mission of the California Institute for Energy Efficiency (CIEE) is to coordinate, plan, and implement a statewide program of medium- to long-term (five to fifteen years) applied research aimed at advancing the energy efficiency and productivity of all end-use sectors in California. The focus of CIEE's multiyear research and development (R&D) program is to benefit California's ratepayers within the context of the state's energy, environmental, and economic needs and priorities. This context includes the current research efforts of CIEE's sponsors, of significant national R&D organizations, and of industry. CIEE's 1992–1996 Multiyear Research Plan guides the Institute's research development, research management, and technology transfer efforts. The Plan briefly describes CIEE's current R&D program and introduces potential R&D initiatives that are responsive to California's unmet energy efficiency needs. In 1992, CIEE is planning, funding, and managing $5 million in multiyear research, exploratory research, Director's discretionary research, and technology transfer activities. The Institute's 1992 effort includes $3.6 million in multiyear research conducted in the Building Energy Efficiency, Air Quality Impacts of Energy Efficiency, and End-Use Resource Planning programs and $1 million in exploratory and Director's discretionary research. During the period 1992 to 1996, CIEE will continue to conduct energy efficiency R&D that will secure sustainable, affordable energy for California while improving the state's economy and environment.

785 (PNL–8225) **Impact evaluation of an energy $avings plan project at Elf Atochem North America.** Brown, D.R.; Spanner, G.E. Pacific Northwest Lab., Richland, WA (United States). Aug 1992. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93000838. Source: OSTI; NTIS; INIS; GPO Dep.

This impact evaluation of an energy conservation measure (ECM) that was recently installed at Elf Atochem North America (Atochem) was conducted for the Bonneville Power Administration (Bonneville) as part of an evaluation of its Energy savings Plan (E$P) Program. The Program makes acquisition payments to firms that install energy conservation measures in their industrial processes. The objective of this impact evaluation was to assess how much electrical energy is being saved at Atochem as a result of the E$P and to determine how much the savings cost Bonneville and the region. The impact of the ECM was evaluated with a combination of engineering analysis, financial analysis, site visit and interview, review of previous program submittals and review of process evaluation results from 1989. The ECM itself consists of adding anode area to each of the sodium chlorate (chlorate) cells at Atochem's Tacoma facility. Increasing the anode area reduces the current density, which reduces cell resistance at the same current, thus reducing energy consumption at the same chlorate production rate. Energy savings resulting from this ECM are expected to average about 24,000,000 kWh/yr or about 1000 kWh/ton of chlorate produced. The net cost of the ECM was $1,410,400, and Atochem received a payment of $212,500 from Bonneville for the acquisition of energy savings. The levelized cost of these energy savings to Bonneville will be 0.7 mills/kWh over the ECM's expected 15-year life, and the levelized cost to the region will be 5.7 mills/kWh. Bonneville's offer to pay Atochem $212,500 via the E$P Program was viewed by Atochem management as a big incentive that made a difference.

786 (PNL–8336) **A review of selected energy-related data sets.** Nicholls, A.K. (Pacific Northwest Lab., Richland, WA (United States)); Elliott, D.B.; Jones, M.L.; Hannifan, J.M.; Degroat, K.J.; Eichner, M.J.; King, J.E. Pacific Northwest Lab., Richland, WA (United States). Sep 1992. 167p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93002180. Source: OSTI; NTIS; GPO Dep.

DOE's Office of Planning and Assessment (OPA) performs cross-cutting technical, policy, and environmental assessments of energy technologies and markets. To support these efforts, OPA is in the process of creating a data base management system (DBMS) that will include relevant data compiled from other sources. One of the first steps is a review of selected data sets that may be considered for inclusion in the DBMS. The review covered data sets in five categories: buildings-specific data, industry-specific data,

transportation-specific data, utilities-specific data, and crosscutting/general data. Reviewed data sets covered a broad array of energy efficiency, renewable, and/or benchmark technologies. Most data sets reviewed in this report are sponsored by Federal government entities and major industry organizations. Additional data sets reviewed are sponsored by the states of California and New York and regional entities in the Pacific Northwest. Prior to full review, candidate data sets were screened for their utility to OPA. Screening criteria included requirements that a data set be particularly applicable to OPA's data needs, documented, current, and obtainable. To fully implement its DBMS, OPA will need to expand the review to other data sources, and must carefully consider the implications of differing assumptions and methodologies when comparing data.

2920 Supply, Demand, and Forecasting

Refer also to citation(s) 768, 771, 1473

787 (ANL/CP–77467) **ENPEP: An integrated approach to energy planning.** Hamilton, B.P.; Cirillo, R.R.; Buehring, W.A. Argonne National Lab., IL (United States). [1992]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9209160–16: International symposium on energy, environment and information management, Argonne, IL (United States), 15-18 Sep 1992). Order Number DE92041085. Source: OSTI; NTIS; GPO Dep.

Many models have been developed to analyze various aspects of the energy system. The Energy and Power Evaluation Program (ENPEP) is a set of microcomputer-based energy planning tools that are designed to provide an integrated analysis capability. ENPEP begins with a macroeconomic analysis, develops an energy demand forecast based on this analysis, carries out an integrated supply/demand analysis for the entire energy system, evaluates the electric system component of the energy system in detail, and determines the impacts of alternative configurations. This approach is an enhancement of existing techniques in that it places emphasis on looking at the electric system as an integral part of the entire energy supply system. Also, it explicitly considers the impacts the power system has on the rest of the energy system and on the economy as a whole.

788 (NEDO-P–9122) **Research on very long-term energy supply and demand. (3).** New Energy and Industrial Technology Development Organization, Tokyo (Japan). Mar 1992. 215p. (In Japanese). Sponsored by New Energy and Industrial Technology Development Organization, Tokyo (Japan). Order Number DE93723969. Source: OSTI; NTIS.

A model is developed which can simulate a relationship between the new energy cost, the amount of new energy to be politically introduced and the amount of new energy to be introduced based on the market mechanism as a tool for analysis of new energy introduction. The model targets a very long period by 2030 and by giving it parameters concerning new energy costs and the conventional energy forecast as variables, the future new energy introduction amount and the conventional energy amount to be replaced thereby can be comprehended by sector. The amount is divided into the following sectors: market, electric utilities, industry, residence/commerce and transportation. The analysis of effects on CO_2 emission can also be made. The model is composed of the following systems: very long-term energy supply demand model calculation, input interactive type and output interactive type. Various kinds of the analysis on new energy introduction can contribute to making and introducing the future new energy policy. 26 figs., 43 tabs.

789 (SA-PUB–9/89-Vol.2, pp. 245-274) **Global climatic change: implications for energy policy.** Abrahamson, D. (Minnesota Univ., Minneapolis, MN (US). Hubert H. Humphrey Institute of Public Affairs); Johansson, T.B. Academy of Finland, Helsinki (Finland). 1989. (CONF-8909491–Vol.2: Conference on climate and water, Helsinki (Finland), 11-15 Sep 1989). In *Conference on climate and water: Volume 2.* 393p. Order Number DE93721621. Source: OSTI; NTIS.

Global climatic change will heavily impact the energy sector: Existing energy systems will be affected by changes in temperature, precipitation, river flows, and temperature-sensitive energy demands; The energy supply system will be much more affected by measures to limit climatic change. To formulate strategies to limit climatic change requires the simultaneous consideration of other criteria such as the need to provide for world-wide economic development, global security implications of dependence on Persian Gulf oil and large-scale nuclear power, and environmental restrictions. The two key strategies are effective use of energy and the use of renewable energy sources. Technologies are available to reduce energy consumption in industrialized countries by at least 50 percent without loss of energy services and meeting the usual tests of economic efficiency. Photovoltaic systems suitable for small- and large-scale applications are on the near horizon, as are advanced fuel cells and advanced gas turbines which may be coupled with biomass gasification plants. Energy conservation and renewable energy supplies are no longer optional, they are now required if climate change is to be limited.

2930 Policy, Legislation, and Regulation

Refer also to citation(s) 770, 1770

790 (NEI-DK–974, pp. 43-45) **Iniatives at government level.** Eriksen, T. (Trafikministeriet (DK)). Hovedstadsraadets Trafikselskab, Valby (Denmark); Trafikministeriet, Copenhagen (Denmark). 1992. 96p. (In Danish). (CONF-9204202–: Conference on traffic, Humlebaek (Denmark), 10 Apr 1992). In *Traffic at Louisiana: Contributions to the conference.* Order Number DE93721449. Source: OSTI; NTIS.

In the field of public transport, the most important part of the central government has been to provide the necessary framework in the form of legislation and other provisions. However, in the field of railway transport, the government plays a direct, active role. Bus and coach transport is highly decentralized. The responsibility for public transport is very much a local matter. The underlying principle is that the right to decide and the responsibility to be held go with the funding. In 1990 the government prepared a transport action plan, which contains a number of goals to be reached and a number of possible courses of action to be taken. One of the core elements of the transport action plan is to use the most ecofriendly and energy-saving means of transport. In a number of situations, public transport is the right answer. The fiscal bill for 1992 provides pool funds to follow up on the transport action plan, aiming at making public transport more environmentally benign. A new initative in the field of transport is a Transport Board, whose job will be to promote research, strengthen and build up research environments and promote the training of scientists. Furthermore, the Transport Board must promote Danish participation in international research and the channeling of research results, in addition to having analyses made upon the wish of the Danish Parliament or the government. (au).

791 (NORD–91-53) **Energy for Europe - resources, economy, cooperation: Report from a Nordic council seminar.** Nordic Council, Stockholm (Sweden). 1991. 94p. (CONF-9110419–: Energy for Europe, Oslo (Norway), 14-15 Oct 1991). Order Number DE93711221. Source: OSTI; NTIS.

At the seminar the plans for an all-European energy policy also including countries outside the European Community, were presented and discussed. The energy situation of Europe with its economic, environmental and social aspects was illustrated by several representatives of Nordic and East European countries. The reports gives an account of the main points made by the speakers, and does not present a full record of the proceedings.

2940 Fossil Fuels

Refer also to citation(s) 129, 146, 764, 798, 799

792 (DOE/EIA–0035(92/08)) **Monthly energy review, August 1992.** USDOE Energy Information Administration, Washington, DC (United States). Office of Energy Markets and End Use. 25 Aug 1992. 174p. Sponsored by USDOE, Washington, DC (United States). Order Number DE92040852. Source: OSTI; NTIS; GPO; GPO Dep.

This publication presents information and compiled data on energy sources. The following information is presented: energy overview; energy consumption; petroleum; natural gas; oil and gas resource development; coal; electricity; nuclear energy; energy prices; and international energy.

793 (DOE/EIA–0109(92/09)) **Petroleum supply monthly, September 1992.** USDOE Energy Information Administration, Washington, DC (United States). Office of Oil and Gas. 28 Sep 1992. 158p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93000624. Source: OSTI; NTIS; GPO; GPO Dep.

Data presented in the PSM describe the supply and disposition of petroleum products in the United States and major US geographic regions. The data series describe production, imports and exports, inter-Petroleum Administration for Defense (PAD) District movements, and inventories by the primary suppliers of petroleum products in the United States (50 States and the District of Columbia). The reporting universe includes those petroleum sectors in Primary Supply. Included are: petroleum refiners, motor gasoline blenders, operators of natural gas processing plants and fractionators, inter-PAD transporters, importers, and major inventory holders of petroleum products and crude oil. When aggregated, the data reported by these sectors approximately represent the consumption of petroleum products in the United States. Data presented in the PSM are divided into two sections (1) the Summary Statistics and (2) the Detailed Statistics.

794 (DOE/EIA–0543(92/2Q)) **US Energy Industry Financial Developments: 1992 Second quarter.** USDOE Energy Information Administration, Washington, DC (United States). Office of Energy Markets and End Use. Sep 1992. 19p. Sponsored by USDOE, Washington, DC (United States). Order Number DE92041309. Source: OSTI; NTIS; INIS; GPO; GPO Dep.

In the second quarter of 1992, the financial performance of the US petroleum industry continued to deteriorate, as weakening domestic economic growth slowed the demand for refined petroleum products. Net income for 119 petroleum companies–including 19 major oil and gas producers–declined 2 percent between the second quarter of 1991 and the second quarter of 1992, and was down 35 percent for the first 6 months of 1992. Unless otherwise stated, all quarterly comparisons relate to the second quarter of 1992 versus the second quarter of 1991. Weak margins reduce downstream earnings; higher prices increase oil and gas production earnings; industry downsizing improves financial results; oil and gas drilling remains depressed; cool spring helps gas companies but disappoints electric utilities.

2950 Hydrogen and Synthetic Fuels

Refer also to citation(s) 2421

2960 Electric Power

Refer also to citation(s) 398, 439, 768, 792

795 (ANL/CP–77471) **Applying environmental externalities to US Clean Coal Technologies for Taiwan.** Szpunar, C.B.; Gillette, J.L. Argonne National Lab., IL (United States). [1992]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9209160–14: International symposium on energy, environment and information management, Argonne, IL (United States), 15-18 Sep 1992). Order Number DE92041087. Source: OSTI; NTIS; INIS; GPO Dep.

During the period 1971 to 1980, electricity consumption in Taiwan increased remarkably at an average rate of 12.2% per year. Despite experiencing a record low in 1982 and 1983, electricity demand returned to double digit growth, reaching 11.6% and 10.2% in 1987 and 1988, respectively, due to a strong economic recovery. In 1988, 71.6 TWh of electricity was produced, 21.1 TWh of which was from coal-fired units (29%). The electricity demand for Taiwan is expected to continue to grow at a very rapid rate during the 1990–2006 time frame. The average load is expected to grow at an annual rate of 5.6% while the peak load is projected to increase at an annual rate of 6.0%. All new coal-fired power plants are expected to comply with government regulations on SO_2, NO_x, and particulate emissions. Taper reports that all of its proposed coal-fired units will be equipped with modern flue gas emission reduction devices, such as electrostatic precipitators or baghouse filters, flue gas desulfurization and $deco_x$ devices, to reduce the pollutants to their minimum practical levels. New coal-based generation requirements in the sizes needed in Taiwan create an opportunity for several of the Cats currently under demonstration in the United States. Options to be considered are described.

796 (ANL/EAIS/TM–76) **C&RE-SLC: Database for conservation and renewable energy activities.** Cavallo, J.D.; Tompkins, M.M.; Fisher, A.G. Argonne National Lab., IL (United States). Environmental Assessment and Information Sciences Div. Aug 1992. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE93001929. Source: OSTI; NTIS; GPO Dep.

The Western Area Power Administration (Western) requires all its long-term power customers to implement programs that promote the conservation of electric energy or facilitate the use of renewable energy resources. The hope is that these measures could significantly reduce the amount of environmental damage associated with electricity production. As part of preparing the environmental impact statement for Western's Electric Power Marketing Program, Argonne National Laboratory constructed a database of the conservation and renewable energy activities in which Western's Salt Lake City customers are involved. The database provides information on types of conservation and renewable energy activities and allows for comparisons of activities being conducted at different utilities in the Salt Lake City region. Sorting the database allows Western's Salt Lake City customers to be classified so the various activities offered by different classes of utilities can be identified; for example, comparisons can be made between municipal utilities and cooperatives or between large and small customers. The information included in the database was collected from customer planning documents in the files of Western's Salt Lake City office.

797 (CONF-9210170–1) **Key factors affecting the success of Demand-Side Management collaboratives.** Schweitzer, M. (Oak Ridge National Lab., TN (United States)); Raab, J. Oak Ridge National Lab., TN (United States). Sep 1992. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 1992 International Energy Efficiency (IEE) and Demand Site Management (DSM) conference; Toronto (Canada); 20-22 Oct 1992. Order Number DE92041253. Source: OSTI; NTIS; GPO Dep.

In recent years, many utilities and nonutility parties (NUPs) across the country have tried a new approach to reaching agreement on Demand-Side Management (DSM) program design and policy issues. The DSM collaborative process, as it is called, represents an attempt by groups that have often been adversaries to work together intensively from the very beginning of the DSM planning process to reach consensus on the issues that have separated them and to produce a plan that is mutually acceptable to all parties. The NUPs involved in collaboratives include environmental and consumer groups, state agencies, and sometimes staff of the regulatory agencies. In a recent study, we analyzed nine cases of DSM collaboration in ten states. These collaboratives have involved 24 utilities and over 50 NUPs in 10 states. The size of the collaboratives ranged from just two parties in the New England Electric System (NEES) - Conservation Law Foundation of New England (CLF) Collaborative to 28 in the Wisconsin Collaborative. The collaboratives included in this study constitute the majority of DSM collaboratives underway at the time this study was initiated and include those with the longest track records. Our study examined the context and organization of DSM collaboratives and the extent to which these collaboratives were successful. Success was measured by a broad array of criteria, including the achievement of consensus by collaborative participants, approval of the resulting DSM plan by state regulators (e.g., Public Utility Commissions) and courts, satisfaction of participants' objectives, savings of time and money compared to the likely results of traditional litigation, and changes in historic relations among the parties. We were able to identify a substantial number of contextual and

organizational characteristics that help determine collaborative success. This paper focuses on five such characteristics that might be particularly interesting to a broad audience.

798 (DOE/EIA–0226(92/09)) **Electric power monthly, September 1992.** USDOE Energy Information Administration, Washington, DC (United States). Office of Coal, Nuclear, Electric and Alternate Fuels. 16 Sep 1992. 188p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93000833. Source: OSTI; NTIS; GPO; GPO Dep.

The Electric Power Monthly is prepared by the Survey Management Division; Office of Coal, Nuclear, Electric and Alternate Fuels, Energy Information Administration (EIA), Department of Energy. This publication provides monthly statistics at the national, Census division, and State levels for net generation, fuel consumption, fuel stocks, quantity and quality of fuel, cost of fuel, electricity sales, revenue, and average revenue per kilowatthour of electricity sold. Data on net generation, fuel consumption, fuel stocks, quantity and cost of fuel are also displayed for the North American Electric Reliability Council (NERC) regions. Additionally, statistics by company and plant are published in the EPM on capability of new plants, net generation, fuel consumption, fuel stocks, quantity and quality of fuel, and cost of fuel.

799 (DOE/EIA–0376(90)) **State energy price and expenditure report 1990.** USDOE Energy Information Administration, Washington, DC (United States). Office of Energy Markets and End Use. 11 Sep 1992. 282p. Sponsored by USDOE, Washington, DC (United States). Order Number DE92041347. Source: OSTI; NTIS; INIS; GPO; GPO Dep.

The State Energy Price and Expenditure Report (SEPER) presents energy price and expenditure estimates individually for the 50 States and the District of Columbia and in aggregate for the United States. The estimates are provided by energy source and economic sector. This report is an update of the State Energy Price and Expenditure Report 1989 published in September 1991. Energy price and expenditure estimates are published for the years 1970, 1975, 1980, and 1985 through 1990. Documentation follows the tables and describes how the price estimates are developed, including sources of data, methods of estimation, and conversion factors applied.

800 (SRC–7523-R6) **Guidebook for Farmstead Demand-Side Management (DSM) program design: [Final report].** Rose, M.; Camera, R.K. Synergic Resources Corp., Bala-Cynwyd, PA (United States). 21 Feb 1992. 115p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG01-89CE28309. Order Number DE93000895. Source: OSTI; NTIS; GPO Dep.

The acceptance and growth of Demand-Side Management (DSM) continues to increase in the US. According to latest estimates, total expenditures on electric utility DSM programs now exceed $1.2 billion annually, with these investments ranging from 1 to 5 percent of a utility's gross revenues. In addition, due to increasing environmental concerns and the high cost of new capacity, these expenditure levels are expected to increase. While the vast majority of these DSM programs are directed at the more traditional residential, commercial and industrial market sectors, significant opportunities still exist. One market segment that has not been the focus of attention but a critical sector from an economic development perspective for marry utilities – is the agricultural and farmstead market. Although the total number of farms in the United States decreased by approximately 5 percent between 1985 and 1989, the land dedicated to farming still accounts for over 995 million acres. Furthermore, the total value of farm output in the United States has been steadily increasing since 1986. The limited penetration of energy efficiency measures in farmsteads provides an excellent opportunity for utilities to expand their DSM programming efforts to capture this "non-traditional" market segment, and at the same time assist farms in increasing their efficiency and competitiveness. In marry states, and, in particular New York State, agriculture plays a major economic role. The importance of farms not only from a utility perspective but also from a state and federal perspective cannot be overstated. As such, utilities are in a unique position to facilitate farmstead DSM technology investments in an effort to benefit the farmer (and his profitability), the utility, the state and the country. This guidebook is designed to provide the framework for agricultural demand planning, including market assessment, technology assessment, market penetration analysis and program design.

2980 Consumption and Utilization

Refer also to citation(s) 775, 782, 796, 798, 799

2990 Unconventional Sources and Power Generation

Refer also to citation(s) 370, 391, 398, 400, 406, 407, 411, 412, 420, 935

801 (INIS-mf–13362) **Renewable energy sources '91. Part 2: Wind energy, biogas, small hydroelectric power plants.** Michalicka, L. Czechoslovak Solar Energy (Czechoslovakia); Ceske Vysoke Uceni Technicke, Prague (Czechoslovakia). 1991 121p. (In Czech, English). (CONF-9107237–: Renewable energy sources '91 international conference, Prague (Czechoslovakia), 1 Jul 1991). Order Number DE93605634. Source: OSTI; NTIS (US Sales Only); INIS.

Part 2 of the proceedings is devoted to the use of the energy of wind, biogas and small hydroelectric sources. The publication contains 14 contributions, out of which 3 have been inputted in INIS. They deal with a wind power plant in Sweden and its environmental impacts, economic aspects of the introduction of alternative energy sources in Czechoslovakia, and with the efficiency of application of a Fresnel lens-based solar collector. (M.D.). 5 figs., 1 tab., 2 refs.

802 (INIS-mf–13363) **Renewable energy sources '91. Part 3: Conference report, post-deadline papers.** Michalicka, L. Czechoslovak Solar Energy (Czechoslovakia); Ceske Vysoke Uceni Technicke, Prague (Czechoslovakia). 1991 100p. (In Czech, English). (CONF-9107237–: 1991 renewable energy sources international conference, Prague (Czechoslovakia), 1-4 Jul 1991). Order Number DE93605594. Source: OSTI; NTIS (US Sales Only); INIS.

Part 3 of the proceedings contains a report on the conference and 10 contributions, out of which 2 have been inputted in INIS: one deals with the economic problems of wind-, solar- and oil-driven water pumps, the other deals with the decrease in sunshine brought about by the operation of Czechoslovak nuclear power plants. (M.D.). 4 tabs., 10 figs., 10 refs.

803 (NEDO-P–9101) **Present status and future trend of cooperation in new energy (the U.S.).** New Energy and Industrial Technology Development Organization, Tokyo (Japan). Mar 1992. 61p. (In Japanese). Sponsored by New Energy and Industrial Technology Development Organization, Tokyo (Japan). Order Number DE93723959. Source: OSTI; NTIS.

Information is collected on the US policy and trend of development and introduction of petroleum substitution energy to promote development and introduction of petroleum substitution energy in Japan effectively and efficiently. The recent history of alternative energy sources tells that a promise has turned to a disillusionment. The industry is besieged by a number of negative marketing factors which have precluded short-term profitability and also have been threatening the survival itself of the companies participating in the industry. On a long-term basis, alternative energy sources might or might not be more promising than they are now. On a short-term basis, however, the market is characterized by no profits, lack of economic competitive strength and declining governmental assistance. International cooperation in alternative energy sources is not desirable for a majority of the US firms which compete in the industry. 1 fig., 6 tabs.

804 (NEDO-P–9102) **Present status and future trend of cooperation in new energy (Canada).** New Energy and Industrial Technology Development Organization, Tokyo (Japan). Mar 1992. 78p. (In Japanese). Sponsored by New Energy and Industrial Technology Development Organization, Tokyo (Japan). Order Number DE93723960. Source: OSTI; NTIS.

The paper provides information on Canada's petroleum substitution energy policy in a framework of their comprehensive energy and environment policies. In this study it is confirmed that Canada

desires to reduce the per capita energy consumption of a nation and has been making advances in the fields of energy efficiency and energy conservation. At the same time, it is clarified that they intend to decrease their oil dependence by widening utilization of natural gas and giving priority to power generation using nuclear power, hydroelectric power and other substitution fuels. Enhancing interest in the environmental problem is pointed out as the background of Canada's being pressed to increase energy efficiency and utilization of substitution energy. No signs are seen at all of a decline in the tendency to support environmental conservation. As a result, it is also pointed out that Canadian government organizations for scientific technology should be assured of larger independence and freedom, so that they can allocate and use their manpower and resources more effectively. 16 tabs.

805 (NEDO-P–9103) **United Kingdom's policy on energy alternatives to oil and international cooperation.** New Energy and Industrial Technology Development Organization, Tokyo (Japan). Mar 1992. 50p. (In Japanese). Sponsored by New Energy and Industrial Technology Development Organization, Tokyo (Japan). Order Number DE93723961. Source: OSTI; NTIS.

The United Kingdom, which has rich oil resource and produces petroleum and natural gas, develops and introduces petroleum substitution energy to consider the global environmental problem, particularly to reduce greenhouse effect gases, rather than to secure resources. In 1990 the government announced their principle policy that CO_2 emission in 2005 should be as it was in 1990, so that the target was set that a capacity of commercial power generation using petroleum substitution energy sources should be 1000MW by 2000. In the same year they enacted the Environmental Protection Act and subsidized environmental protection programs. They also announced that by 2005 they would supply 20% of UK's total electricity output with commercially viable renewable energy by introducing the Non-Fossil Fuel Obligation as legal and administrative measures to introduce petroleum substitution energy to the market. The Department of Energy has given priority to petroleum substitution energy such as photovoltaic power generation, bioregeneration and anaerobic digestion of wastes and wind power energy, and has promoted the research and development. 22 refs., 8 figs., 8 tabs.

806 (NEI-DK–968) **Municipal planning for windmills: Methods, administrative basis, guidelines. Example: Thisted municipality. Plan for wind turbines in Thisted kommune. Working note.** Nellemann Raadgivende Ingenioerer og Planlaeggere A/S, Aarhus (Denmark). Jun 1992 60p. (In Danish). Order Number DE93721411. Source: OSTI; NTIS.

Prepared for Energistyrelsen and Planstyrelsen.

Methods and processes for working out a proposal for a plan for wind turbines in Thisted municipality in Denmark are described. 100 wind turbines are already set up, and it is planned to erect 50 more in the municipality. The discussion concerns the variation in wind strength throughout this comparatively large area, the demands of the existing regional plans, the consideration of the interests of prospective neighbours of the wind turbines and following demands for environmental protection, in addition to the locations of existing wind turbines and proposed siting of the new ones. The administration of the actual planning process is described in detail. (AB).

807 (NEI-DK–971) **Renewable energy technologies: Research, technological development, enterprises 1992.** Moeller Andersen, H. (ed.). Energistyrelsen, Copenhagen (Denmark). 1992 47p. Order Number DE93721467. Source: OSTI; NTIS.

Renewable energy technologies have developed at great speed in Denmark since the energy crisis in the 1970s. Danish wind turbines are already well known internationally and the renewable energy sector as a whole is now an important growth industry in the country. This has been achieved with the aid of a comprehensive research and development programme, involving financial support schemes, public testing and certification, and technology demonstrations. The Danish government has introduced a number of measures designed to bring about significant reductions in energy consumption and emissions. The publication reviews various aspects of renewable energy technologies with particular emphasis on recent developments, and presents key organizations, institutes and public bodies. (AB).

808 (NEI-FI–168, pp. 19-26) **The demonstration programme for wind energy in Norway.** Grorud, C. (Norwegian Water Resources (Norway)). Finnish Wind Power Association, Espoo (Finland). 1990. (CONF-9010521–: FINNWIND'90: conference on wind power in Finland, Pori (Finland), 19-20 Oct 1990). In *Finnwind'90: Presentations.* 120p. Order Number DE93721624. Source: OSTI; NTIS.

A demonstration programme for wind energy has been initiated. The aim is to gain experience and to disseminate information about wind energy through installation and operation of wind turbines. Feasible application in the electricity system has been identified, and proposals for installation of about 20 wind turbines have been received. One project has been realized at the island Hammaroey in Moere og Romsdal.

809 (NEI-FI–168, pp. 27-36) **Finnwind'90, national wind energy programmes, Federal Republic of Germany.** Wollmerath, H. (Foerdergesellschaft Windenergie (Germany, F.R.)). Finnish Wind Power Association, Espoo (Finland). 1990. (CONF-9010521–: FINNWIND'90: conference on wind power in Finland, Pori (Finland), 19-20 Oct 1990). In *Finnwind'90: Presentations.* 120p. Order Number DE93721624. Source: OSTI; NTIS.

Since 1974 windenergy projects have been supported by the Federal Ministry for Research and Development (BMFT) as well for design, stresscalculation, material tests, construction of prototypes as for small series. The programme for windenergy projects for 1990 - 1992 will cover about 150 Mio DM. The federal states of the FRG do have additional programmes, with support the users of Niedersachsen and Schleswig-Holstein are the federal states with the most promising wind areas.

810 (NEI-FI–168, pp. 55-58) **Finnish wind energy programme.** Vainio, P.L. (Ministry of Trade and Industry, Helsinki (Finland). Energy Department). Finnish Wind Power Association, Espoo (Finland). 1990. (CONF-9010521–: FINNWIND'90: conference on wind power in Finland, Pori (Finland), 19-20 Oct 1990). In *Finnwind'90: Presentations.* 120p. Order Number DE93721624. Source: OSTI; NTIS.

Total energy consumption in Finland per capita is one of the highest the world. The rate of total energy growth has been cut to one half of the GDP growth due to active energy policy. Energy saving programmes have been most successful in thermal energy consumption, like space heating. At the same time electricity demand has been growing, and seems to increase also in future. The electricity consumption in Finland last year was about 50 TWh. It is based on nuclear power, hydro power and fossil fuels. Combined heat and power generation is commonly used, about 1/2 of the total supply. Traditionally, wood and peat have been the important renewable, indigenous energy sources in Finland, and hydro power of course. Wind power, is as new possibility in the national power supply. Wind energy has been researched for some time in Finland. In 1988 when national energy research policy was revised, wind energy R and D was included in the NEMO research programme on advanced energy systems.

811 (NEI-FI–168, pp. 61-62) **Wind power test plant to Pori feasibility study.** Pale, P. Finnish Wind Power Association, Espoo (Finland). 1990. (CONF-9010521–: FINNWIND'90: conference on wind power in Finland, Pori (Finland), 19-20 Oct 1990). In *Finnwind'90: Presentations.* 120p. Order Number DE93721624. Source: OSTI; NTIS.

Short communication. FINLAND/energy policy; SHORES/wind power; FINLAND; SHORES; INVESTMENT; FORECASTING; WIND POWER PLANTS

812 (NEI-FI–168, pp. 63-64) **Wind power plans in Aaland.** Phaler, R.V. (AaTC Aalands Teknologicentrum (Finland)). Finnish Wind Power Association, Espoo (Finland). 1990. (CONF-9010521–: FINNWIND'90: conference on wind power in Finland, Pori (Finland), 19-20 Oct 1990). In *Finnwind'90: Presentations.* 120p. Order Number DE93721624. Source: OSTI; NTIS.

Short communication. WIND POWER/forecasting; SHORES/wind power; FINLAND; FORECASTING; SHORES; PLANNING; ENERGY POLICY; DEMONSTRATION PLANTS; WIND POWER PLANTS

813 (NEI-FI–168, pp. 60) **Wind power research at Finnish Lappland by Kemijoki Oy.** Autti, M. (Kemijoki Oy, Rovaniemi (Finland)). Finnish Wind Power Association, Espoo (Finland). 1990. (CONF-9010521–: FINNWIND'90: conference on wind power in Finland, Pori (Finland), 19-20 Oct 1990). In *Finnwind'90: Presentations*. 120p. Order Number DE93721624. Source: OSTI; NTIS.

Short communication. WIND POWER/research programs; POLAR REGIONS/wind power; FINLAND; FORECASTING; WIND POWER PLANTS

814 (NEI-FI–168, pp. 65-71) **Korsnaes windpark.** Byholm, H. (Vasa Elektriska Ab, Korsnaes (Finland)). Finnish Wind Power Association, Espoo (Finland). 1990. (CONF-9010521–: FINNWIND'90: conference on wind power in Finland, Pori (Finland), 19-20 Oct 1990). In *Finnwind'90: Presentations*. 120p. Order Number DE93721624. Source: OSTI; NTIS.

In Korsnaes, a commune on the Finnish west coast there have been plans to build a wind power plant for a couple of years. According to the latest plans a 1 MW windfarm, consisting of five 200 units, will be built. Other possible combinations to obtain the desired size are not excluded yet. The project is planned to be started in 1991, provided that the law about relief from purchase tax on plants for energy production will be accepted by parliament (in October 1991). According to the same law wind produced energy will still be taxable. Today the rate of the sales tax is 17 %.

815 (NEI-FI–168, pp. 106-114) **Modelling and effects of wind power in the Finnish power supply system.** Petaejae, J. (Helsinki Univ. of Technology, Otaniemi (Finland). Machine Design of Power Plants). Finnish Wind Power Association, Espoo (Finland). 1990. (CONF-9010521–: FINNWIND'90: conference on wind power in Finland, Pori (Finland), 19-20 Oct 1990). In *Finnwind'90: Presentations*. 120p. Order Number DE93721624. Source: OSTI; NTIS.

The integration of large amounts of wind power into the Finnish power system has been studied on national level with the ARTS-model, which is able to describe time-dependent production technologies. The model is based on probabilistic production costing using the Equivalent Energy Function -method with multistate probability distributions of wind power, which depend on the period of the year. The temperature dependence of consumption and wind power production are also included in the model. The long term value of wind power in the Finnish power supply system is according to the calculations 0,18 FIM/kWh, which is about 0,1 FIM/kWh less than the production cost of wind power in best places today.

30 DIRECT ENERGY CONVERSION

3001 MHD Generators

Refer also to citation(s) 2204

816 (ANL/CP–76058) **Computer simulation of an advanced combustor for clean coal technology.** Chang, S.L.; Lottes, S.A. Argonne National Lab., IL (United States). [1992]. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9209160–18: International symposium on energy, environment and information management, Argonne, IL (United States), 15-18 Sep 1992). Order Number DE92040742. Source: OSTI; NTIS; GPO Dep.

Magnetohydrodynamic (MHD) power generation is a clean coal technology because of its higher thermal efficiency and lower pollutant emission. Argonne National Laboratory used a comprehensive integral combustion computer code to aid the development of a TRW's second stage combustor for MHD power generation. The integral combustion code is a computer code for two-phase, two-dimensional, steady state, turbulent, and reacting flows, based on mass, momentum, and energy conservation laws for multiple gas species and solid particles of variable sizes. In the MHD second stage combustor, opposed jets of oxidizer are injected into a confined cross-stream coal gas flow laden with seed particles. The performance of the downstream MHD power generation channel depends mainly on the degree and the uniformity of gas ionization, which, in turn, depends on the uniformity of temperature and seed vapor distributions leaving the combustor. The simulation provides in-depth information of flow, combustion, and heat transfer patterns in the combustor, which is used to predict ranges of combustor operating conditions for optimum performance of the MHD system.

817 (ANL/CP–77194) **MHD seawater thruster performance: A comparison of predictions with experimental results from a two Tesla test facility.** Picologlou, B.F. (Argonne National Lab., IL (United States)); Doss, E.D.; Geyer, H.K.; Sikes, W.C.; Ranellone, R.F. Argonne National Lab., IL (United States). [1992]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-921038–5: 11. international conference on magnetohydrodynamics (MHD) electrical power generation, Beijing (China), 12-16 Oct 1992). Order Number DE92041106. Source: OSTI; NTIS; GPO Dep.

A two Tesla test facility was designed, built, and operated to investigate the performance of magnetohydrodynamic (MHD) seawater thrusters. The results of this investigation are used to validate a design oriented MHD thruster performance computer code. The thruster performance code consists of a one-dimensional MHD hydrodynamic model coupled to a two-dimensional electrical model. The code includes major loss mechanisms affecting the performance of the thruster. Among these losses are the joule dissipation losses, frictional losses, electrical end losses, and single electrode potential losses. The facility test loop, its components, and their design are presented in detail. Additionally, the test matrix and its rationale are discussed. Representative experimental results of the test program are presented, and are compared to pretest computer model predictions. Good agreement between predicted and measured data has served to validate the thruster performance computer models.

818 (DOE/ET/10815–195) **Fate of chlorine-containing species in coal-fired MHD system.** Wang, S.H.; Holt, J.K.; Sheth, A.C. Tennessee Univ., Tullahoma, TN (United States). Space Inst. [1992]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-79ET10815. (CONF-921037–5: 9. annual international Pittsburgh coal conference, Pittsburgh, PA (United States), 12-16 Oct 1992). Order Number DE93000786. Source: OSTI; NTIS; GPO Dep.

From pilot plant test measurements, equilibrium calculations and bench scale experiments, the fate of various chlorin-containing species in a coal-fired MHD system has been determined. Chlorine generally occurs in fuel in a form that is easily decomposed or vaporized during combustion. According to a CONOCO bulletin, some Illinois coals contain chlorine concentrations up to 0.65% and many US coals exhibit chlorine contents varying from 0.01% to about 0.5%. Depending upon the grade of the seed material,its chlorine content as KC1 or NaCl can vary from 0.05% to 1.5%. Potassium salts used as seed material in the MHD system are recovered and recycled for economic and environmental reasons. However, multiple recycling results in a potential problem of coal-derived chloride build-up in the MHD system. If such build-up of chlorine-containing species is not controlled below an acceptable level, potentially serious problems may be faced in the entire MHD system. - Also under the new Clean Air Act, emission of HCl (hydrochloric acid) gas/aerosol from a continuous source will have to be brought down from 17 to less than 10 tons/year.

819 (DOE/ID/12735–T24) **Magnetohydrodynamic projects at the CDIF: Quarterly technical progress report, April 1–June 30, 1992.** MSE, Inc., Butte, MT (United States). [1992]. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-88ID12735. Order Number DE93001854. Source: OSTI; NTIS; GPO Dep.

This quarterly technical progress report presents the tasks accomplished at the Component Development and Integration Facility (CDIF) during the third quarter of FY92. Areas of technical progress this quarter included: Coal system development; seed system development; test train/A-Bay modifications; channel power dissipation and distribution system development; and integrated topping cycle current consolidators.

820 (DOE/PC/79672–T3) **MHD seed recovery/regeneration: Phase 2, Technical progress report, quarter ending May 29, 1992.** TRW Space and Technology Group, Redondo

Beach, CA (United States). Applied Technology Div. [1992]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-87PC79672. Order Number DE93000904. Source: OSTI; NTIS; GPO Dep.

Task 1 calls for the design, procurement, construction, and installation of the Seed Regeneration Proof-of-Concept Facility (SRPF) (Figure 1) that will produce tonnage quantities of recyclable potassium formate seed at a design rate of 250 lb/hr for testing in the channel at the CDIF while collecting data that will be used to upgrade the design of a 300 MW_t system. Approximately 12 tons of KCOOH (dry basis) as 70–75 wt% solution have been produced. The front end of the plant (potassium sulfate reaction and solids separation/washing units) was operated for five days in March. Most of the operations were conducted at a spent seed feed rate of 250 pounds/hour. A total of ~8,500 gallons of dilute KCOOH solution was generated containing approximately 2.6 tons of potassium formate (dry basis). The average KCOOH content of this solution was -7 wt%. The design KCOOH solution concentration for the front end of the plant is 8.5 wt%. The evaporation unit was operated or a total six days during March. Approximately 2.5 tons of potassium formate (dry basis) were processed through the evaporator and concentrated to >70 wt%.

821 (DOE/PC/90274–T19) **MHD Integrated Topping Cycle Project: Eighteenth quarterly technical progress report, November 1, 1991–January 31, 1992.** TRW Space and Technology Group, Redondo Beach, CA (United States). Applied Technology Div. Jul 1992. 71p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-87PC90274. (MHD-ITC–92-168). Order Number DE92041285. Source: OSTI; NTIS; GPO Dep.

This eighteenth quarterly technical progress report of the MHD Integrated Topping cycle Project presents the accomplishments during the period November 1, 1991 to January 31, 1992. The precombustor is fully assembled. Manufacturing of all slagging stage components has been completed. All cooling panels were welded in place and the panel/shell gap was filled with RTV. Final combustor assembly is in progress. The low pressure cooling subsystem (LPCS) was delivered to the CDIF. Second stage brazing issues were resolved. The construction of the two anode power cabinets was completed.

822 (DOE/PC/90274–T20) **MHD Integrated Topping Cycle Project: Seventeenth quarterly technical progress report, August 1, 1991–October 31, 1991.** TRW Space and Technology Group, Redondo Beach, CA (United States). Applied Technology Div. Jul 1992. 83p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-87PC90274. (MHD-ITC–92-126). Order Number DE92041284. Source: OSTI; NTIS; GPO Dep.

This seventeenth quarterly technical progress report of the MHD Integrated Topping Cycle Project presents the accomplishments during the period August 1, 1991 to October 31, 1991. Manufacturing of the prototypical combustor pressure shell has been completed including leak, proof, and assembly fit checking. Manufacturing of forty-five cooling panels was also completed including leak, proof, and flow testing. All precombustor internal components (combustion can baffle and swirl box) were received and checked, and integration of the components was initiated. A decision was made regarding the primary and backup designs for the 1A4 channel. The assembly of the channel related prototypical hardware continued. The cathode wall electrical wiring is now complete. The mechanical design of the diffuser has been completed.

3004 Thermionic Converters

Refer also to citation(s) 536

3005 Fuel Cells

823 (DOE/MC/22194–3001) **Development of metal-coated ceramic anodes for molten carbonate fuel cells: Final report.** Khandkar, A.C.; Elangovan, S.; Marianowski, L.G. Ceramatec, Inc., Salt Lake City, UT (United States). Mar 1990. 106p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC21-85MC22194. Order Number DE91002082. Source: OSTI; NTIS; GPO Dep.

This report documents the developmental efforts on metal coating of various ceramic substrates ($LiAlO_2$, $SrTiO_3$, and $LiFeO_2$) and the critical issues associated with fabricating anodes using metal-coated $LiAlO_2$ substrates. Electroless Ni and Cu coating technology was developed to achieve complete metal coverage on $LiAlO_2$ powder substrates. Metal coated $SrTiO_3$ powders were fabricated into anodes by a process identical to that reported in the GE literature. Microstructural examination revealed that the grains of the ceramic had fused together, with the metal having dewetted from the surface of the ceramic. Alternate substrates that might allow for better wetting of the metal on the ceramic such as $LiFeO_2$ and Li_2MnO_3 were identified. Cu/Ni-coated (50:50 mol ratio, 50 w/o metal loading) $LiFeO_2$ anodes were optimized to meet the MCFC anode specifications. Metal-coated gamma-$LiAlO_2$ substrates were also developed. By using suitable chemical surface modification methods, the gamma-$UAlO_2$ substrate surface may be modified to allow a stable metal coated anode to be fabricated. Creep testing of the metal coated ceramic anodes were conducted at IGT. It was determined that the predominant creep mechanism is due to particle rearrangement. The anode porosity, and mean pore size had significant effect on the creep of the anode. Lower porosity and pore size consistent with performance criteria are desired to reduce creep. Lower metal loading with uniformity of coverage will result in lower creep behavior of the anode. Of the two substrates evaluated, $LiFeO_2$ in general exhibited lower creep which was attributed to superior metal adhesion.

824 (DOE/MC/23270–3105) **Molten carbonate fuel cell technology improvement: Final report.** International Fuel Cells Corp., South Windsor, CT (United States). Jun 1991. 180p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC21-87MC23270. (FCR–11486). Order Number DE92001300. Source: OSTI; NTIS; GPO Dep.

This report summarizes the work performed under Department of Energy Contract DEAC21-87MC23270, "Molten Carbonate Fuel Cell Technology Improvement." This work was conducted over a three year period and consisted of three major efforts. The first major effort was the power plant system study which reviewed the competitive requirements for a coal gasifier/molten carbonate fuel cell power plant, produced a conceptual design of a CG/MCFC, and defined the technology development requirements. This effort is discussed in Section 1 of the report. The second major effort involved the design and development of a new MCFC cell configuration which reduced the material content of the cell to a level competitive with competing power plants, simplified the cell configuration to make the components more manufacturable and adaptable to continuous low cost processing techniques, and introduced new-low-pressure drop flow fields for both reactant gases. The new flow fields permitted the incorporation of recirculation systems in both reactant gas systems, permitting simplified cooling techniques and the ability to operate on both natural gas and a wide variety of gasifier fuels. This cell technology improvement is discussed in Section 2. The third major effort involved the scaleup of the new cell configuration to the full-area, 8-sq-ft size and resulted in components used for a 25-kW, 20-cell stack verification test. The verification test was completed with a run of 2200 hours, exceeding the goal of 2000 hours and verifying the new cell design. TWs test, in turn, provided the confidence to proceed to a 100-kW demonstration which is the goal of the subsequent DOE program. The scaleup and stack verification tests are discussed in Sections 3, 4, 5, and 6 of this report.

825 (DOE/MC/24223–3103) **Gas cooled fuel cell systems technology development: Final report.** Westinghouse Electric Corp., Pittsburgh, PA (United States). Nuclear and Advanced Technology Div.; Energy Research Corp., Danbury, CT (United States). Mar 1992. 193p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC21-82MC24223. Order Number DE92001298. Source: OSTI; NTIS; GPO Dep.

This report documents in detail the work performed by Westinghouse Electric Corporation and the Energy Research Corporation during the fourth phase of a planned multiphase program to

develop a Phosphoric Acid Fuel Cell (PAFC) for electric utility or industrial power plant applications. Results of this effort include: (1) development of a baseline rolled electrode technology; (2) advancement of fuel cell technology through innovative improvements in the areas of acid management, catalyst selection, electrode and plate materials and processes, components designs, and quality assurance programs; (3) demonstration of improved fuel cell and stack performance and endurance; (4) successful scaleup of cell and stack design features into fun height 100 kill stacks; and (5) demonstration of combining stacks into a 400 kill module that will be the building block for power plants, including the development of testing facilities and operating procedures applicable to plant operations.

826 (DOE/MC/25009–3123) **Effects of coal-derived trace species on performance of molten carbonate fuel cells: Final report.** Energy Research Corp., Danbury, CT (United States). May 1992. 203p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC21-88MC25009. Order Number DE93000203. Source: OSTI; NTIS; GPO Dep.

The Carbonate Fuel Cell is a very promising option for highly efficient generation of electricity from many fuels. If coal-gas is to be used, the interactions of coal-derived impurities on various fuel cell components need to be understood. Thus the effects on Carbonate Fuel Cell performance due to ten different coal-derived contaminants viz., NH_3, H_2S, $HC\ell$, H_2Se, AsH_3, Zn, Pb, Cd, Sn, and Hg, have been studied at Energy Research Corporation. Both experimental and theoretical evaluations were performed, which have led to mechanistic insights and initial estimation of qualitative tolerance levels for each species individually and in combination with other species. The focus of this study was to investigate possible coal-gas contaminant effects on the anode side of the Carbonate Fuel Cell, using both out-of-cell thermogravimetric analysis by isothermal TGA, and fuel cell testing in bench-scale cells. Separate experiments detailing performance decay in these cells with high levels of ammonia contamination (1 vol %) and with trace levels of Cd, Hg, and Sn, have indicated that, on the whole, these elements do not affect carbonate fuel cell performance. However, some performance decay may result when a number of the other six species are present, singly or simultaneously, as contaminants in fuel gas. In all cases, tolerance levels have been estimated for each of the 10 species and preliminary models have been developed for six of them. At this stage the models are limited to isothermal, bench-scale (300 cm^2 size) single cells. The information obtained is expected to assist in the development of coal-gas cleanup systems, while the contaminant performance effects data will provide useful basic information for modeling fuel cell endurance in conjunction with integrated gasifier/fuel-cell systems (IGFC).

827 (DOE/MC/25026–3106) **Development of a coal-fueled Internal Manifold Heat Exchanger (IMHEX®) molten carbonate fuel cell: Volumes 1–6, Final report.** Institute of Gas Technology, Chicago, IL (United States). Sep 1991. 402p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC21-88MC25026. Order Number DE92012451. Source: OSTI; NTIS; GPO Dep.

The design of a CGMCFC electric generation plant that will provide a cost of eletricity (COE) which is lower than that of current electric generation technologies and which is competitive with other long-range electric generating systems is presented. This effort is based upon the Internal Manifold Heat Exchanger (IMHEX) technology as developed by the Institute of Gas Technology (IGT). The project was executed by selecting economic and performance objectives for alternative plant arrangements while considering process constraints identified during IMHEX fuel cell development activities at IGT. The four major subsystems of a coal-based MCFC power plant are coal gasification, gas purification, fuel cell power generation and the bottoming cycle. The design and method of operation of each subsystem can be varied, and, depending upon design choices, can have major impact on both the design of other subsystems and the resulting cost of electricity. The challenge of this project was to select, from a range of design parameters, those operating conditions that result in a preferred plant design. Computer modelling was thus used to perform sensitivity analyses of as many system variables as program resources and schedules would permit. In any systems analysis, it is imperative that the evaluation methodology be verifiable and comparable. The TAG Class I develops comparable (if imprecise) data on performance and costs for the alternative cases being studied. It identifies, from a range of options, those which merit more exacting scrutiny to be undertaken at the second level, TAG class II analysis.

828 (DOE/MC/27394–92/C0047) **Simulated coal gas MCFC power plant system verification.** Benjamin, T.G.; Camara, E.H.; Laurens, R.; Marianowski, L.G. M-C Power Corp., Burr Ridge, IL (United States). [1992]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC21-90MC27394. (CONF-920748–22: US Department of Energy contractors review meeting on fuel cells, Morgantown, WV (United States), 14-15 Jul 1992). Order Number DE92040939. Source: OSTI; NTIS; GPO Dep.

The overall program objective is the demonstration of a full-scale, full-height IMHEX ® molten carbonate fuel cell stack in a 250 kW dual-fuel power plant test on natural gas and simulated coal gas. Issues impeding development of manufacturing and testing facilities will be addressed in support of MCFC stack research and power plant development. Issues will be identified and resolved in engineering, manufacturing, assembling, cost, performance, and endurance of the stack repeat and non-repeat components. The program is being executed by M-C Power (MCP) and several major subcontractors.

829 (LBL–32577) **Solid-polymer-electrolyte fuel cells.** Fuller, T.F. Lawrence Berkeley Lab., CA (United States). Jul 1992. 248p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. Order Number DE92041204. Source: OSTI; NTIS; GPO Dep.

A transport model for polymer electrolytes is presented, based on concentrated solution theory and irreversible thermodynamics. Thermodynamic driving forces are developed, transport properties are identified and experiments devised. Transport number of water in Nafion 117 membrane is determined using a concentration cell. It is 1.4 for a membrane equilibrated with saturated water vapor at 25°C, decreases slowly as the membrane is dehydrated, and falls sharply toward zero as the water content approaches zero. The relation between transference number, transport number, and electroosmotic drag coefficient is presented, and their relevance to water-management is discussed. A mathematical model of transport in a solid-polymer-electrolyte fuel cell is presented. A two-dimensional membrane-electrode assembly is considered. Water management, thermal management, and utilization of fuel are examined in detail. The membrane separators of these fuel cells require sorbed water to maintain conductivity; therefore it is necessary to manage the water content in membranes to ensure efficient operation. Water and thermal management are interrelated. Rate of heat removal is shown to be a critical parameter in the operation of these fuel cells. Current-voltage curves are presented for operation on air and reformed methanol. Equations for convective diffusion to a rotating disk are solved numerically for a consolute point between the bulk concentration and the surface. A singular-perturbation expansion is presented for the condition where the bulk concentration is nearly equal to the consolute-point composition. Results are compared to Levich's solution and analysis.

830 (NEDO-P–9118) **Survey on polymer electrolyte fuel cell for its research and development.** New Energy and Industrial Technology Development Organization, Tokyo (Japan). Mar 1992. 100p. (In Japanese). Sponsored by New Energy and Industrial Technology Development Organization, Tokyo (Japan). Order Number DE93723968. Source: OSTI; NTIS.

Fundamental studies are made on development of polymer electrolyte fuel cells (PEFC). PEFC is a low-temperature operation type, of which exhaust heat is obtained as hot water, and is suitable for small-size dispersed distribution. It is high in energy density, and its cell voltage over 0.8V and conversion efficiency higher than that of phosphoric acid fuel cells are obtained. When it is used for cogeneration as an onsite type, hot water around 70 centigrade can be recovered. PEFC is used as a transferable power source for the electric car which is low air-pollutant, and petroleum substitution methanol can be used as its fuel. PEFC works at a normal temperature and is quick to start up and becomes high in energy density. A PEFC-electric battery hybrid car is

now under development in the U.S. and Canada. PEFC is expected also as a portable power source. Studies are made on improvement of the fuel reforming method and the use of perfluorinated ion exchange membranes for fuel cell. Further studies are made on the cell body and the constructure of the fuel cell system as developmental subjects. 63 refs., 65 figs., 28 tabs.

32 ENERGY CONSERVATION, CONSUMPTION, AND UTILIZATION

3201 Buildings

Refer also to citation(s) 738, 740, 784, 1087, 1088, 1090, 1498, 2444

831 (ANL/CP–77435) **An analysis of heating and cooling conservation features in commercial buildings.** Sutherland, R.J. Argonne National Lab., IL (United States). [1990]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-900833–18: 6. American Council for an Energy-Efficient Economy (ACEEE) summer study on energy efficiency in buildings, Pacific Grove, CA (United States), 26 Aug - 1 sep 1990). Order Number DE93000606. Source: OSTI; NTIS; GPO Dep.

One purpose of this study is to estimate the relationship in commercial buildings between conservation investments, fuel prices, building occupancy and building characteristics for new buildings and for existing buildings. The database is a nationwide survey of energy in commercial buildings conducted by the Energy Information Administration (EIA) in 1906. Some simple cross-tabulations indicate that conservation measures vary with building size, building age, and fuel used for building heating. Regression estimates of a conservation model indicate that the number of conservation model indicate that the number of conservation features installed during construction is a positive function of the price of the heating fuel at the time of construction. Subsequent additions of conservation features are positively correlated with increases in heating fuel prices. Given the EIA projection of relatively stable future energy prices, the number of retrofits may not increase significantly. Also, energy efficiency in new buildings may not continue to increase relative to current new buildings. If fuel prices affect consumption via initial conservation investments, current fuel prices, marginal or average, are not the appropriate specification. The fuel price regression results indicate that conservation investments in new buildings are responsive to market signals. Retrofits are less responsive to market signals. The number of conservation features in a building is not statistically related to the type of occupancy (owner versus renter), which implies that conservation strategies are not impeded by the renting or leasing of buildings.

832 (BNL–52341) **Proceedings of the 1992 DOE-Industry thermal distribution conference.** Andrews, J.W. (ed.). Brookhaven National Lab., Upton, NY (United States). Jun 1992. 147p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-9203193–: 1992 DOE-industry thermal distribution conference, Washington, DC (United States), 30-31 Mar 1992). Order Number DE93002116. Source: OSTI; NTIS; GPO Dep.

The subject of the conference was thermal distribution in small buildings. Thermal distribution systems are the ductwork, piping, or other means used to transport heat or cooling effect from the equipment in which the heat or cooling is produced to the building spaces in which it is used. The small buildings category is defined to include single-family residential and multifamily and commercial buildings with less than 10,000 ft^2 floor area. The 1992 DOE-Industry Thermal Distribution Conference was conceived as the beginning of a process of information transfer between the DOE and the industries having a stake in thermal distribution systems, whereby the DOE can make the industry aware of its thinking and planned directions early enough for changes to be made, and whereby the industries represented can provide this input to the DOE on a timely and informed basis. In accordance with this, the objectives of the Conference were: To present–to a representative group of researchers and industry representative–the current industry thinking and DOE's current directions for research in small-building thermal distribution. To obtain from industry and the research community a critique of the DOE priorities and additional ideas concerning how DOE can best assist the industry in promoting energy conservation in thermal distribution systems.

833 (CONF-9209231–1-Draft) **Energy performance and installation considerations for retrofitted exterior masonry wall insulation: Draft.** Ternes, M.P.; Wilkes, K.E. Oak Ridge National Lab., TN (United States). [1992]. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From International symposium on exterior insulation and finish systems; Arlington, VA (United States); 21-24 Sep 1992. Order Number DE92041256. Source: OSTI; NTIS; GPO Dep.

A field test involving eight single-family houses was performed during the summer of 1991 in Scottsdale, Arizona to evaluate the potential of reducing air-conditioning electricity consumption and demand by insulating their exterior masonry walls. The installation technique. Total per house costs to perform the installations ranged from $3610 to $4550. The average annual savings was estimated to be 491 kWh, or 9% of pre-retrofit consumption. Peak demands with and without insulation on the hottest day of an average weather year for Phoenix were estimated to be 4.26 and 3.61 kill, for a demand reduction of 0.65 kW (15%). We conclude that inclusion of exterior masonry wall insulation in conservation programs aimed at reducing air-conditioning electricity consumption and peak demand should be pursued in hot, dry climates.

834 (CONF-921203–1) **Energy and global warming impacts of CFC alternative technologies for foam building insulations.** Fischer, S.K.; Fairchild, P.D.; Hughes, P.J. Oak Ridge National Lab., TN (United States). [1992]. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Thermal performance of the exterior envelopes of buildings; Clearwater, FL (United States); 7-10 Dec 1992. Order Number DE92019477. Source: OSTI; NTIS; INIS; GPO Dep.

Chlorofluorocarbons (CFCS) have been used as blowing agents in foam insulation, as the working fluids in cooling and refrigeration equipment, and as solvents in general and precision cleaning applications since their introduction in the 1930s. The number of applications and volumes of CFCs used grew at a tremendous pace during the 1960s and 1970s, but in the mid-1980s it was confirmed that these extremely useful chemicals contribute to the destruction of stratospheric zone and that they are the primary cause of the CFCs have also been found to be second only to carbon dioxide as a factor causing increased greenhouse warming. These chemicals are being phased out of use rapidly to protect the ozone layer and it is very important that the replacements for CFCs do not result in a net increase in global warming by introducing less efficient processes that lead to higher energy use and increased carbon dioxide emissions. A study was conducted to identify those alternative chemicals and technologies that could replace CFCs in energy related applications before the year 2000, and to assess the total potential impact of those alternatives on global warming. The analysis for this project included an estimate of the direct effects from the release of blowing agents, refrigerants, and solvents into the atmosphere and the indirect effects of carbon dioxide emissions resulting from energy use for commercial and residential building insulation, household and commercial refrigeration, building and automobile air conditioning, and general metal and electronics solvent cleaning. This paper focuses on those aspects of the study relevant to building insulation. In general the hydrofluorocarbon (HFC) and hydrochlorofluorocarbon alternatives for CFCs lead to large and sometimes dramatic reductions in total equivalent warming impact, lifetime equivalent $C0_2$ emissions (TEWI). Most of the reductions result from decreased direct effects without significant changes in energy use.

835 (CONF-921203–2) **System effects on the thermal aging of experimental polyisocyanurate roof insulation foamed with an alternative blowing agent.** Desjarlais, A.O.; Christian, J.E; Linkous, R.L. Oak Ridge National Lab., TN (United States). [1992]. 28p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Thermal performance of the exterior envelopes of buildings; Clearwater, FL

(United States); 7-10 Dec 1992. Order Number DE92019967. Source: OSTI; NTIS; GPO Dep.

Experimental polyisocyanurate foam roof insulation with 0.6mm thick permeable black facers blown with HCFC-141b installed on test roofs at the Oak Ridge National Laboratory for almost three years show various degrees of aging. Four roof systems are being monitored to determine the effect of system type on board aging. The four systems are comprised of a dry stack of insulation boards covered, respectively, by a loose-laid single ply white membrane, a loose-laid single ply black membrane, a built-up roof (BUR), and a fully adhered ethylene propylene diene monomer (EPDM) membrane. A comparison to periodic laboratory testing of the insulation boards is also included. The data analysis program, PROPOR, has been used to estimate the thermal properties of the polyisocyanurate foam insulation, to gain insight into the data and the pure conduction model used by PROPOR through sequential value and residual analyses, and to estimate precision of the results with confidence intervals. These confidence intervals are then used to determine if the differences noted due to aging of the insulation boards contained within these systems are statistically significant.

836 (CONF-921203–3) **Thermal performance of fiberglass and cellulose attic insulations.** Wilkes, K.E.; Childs, P.W. Oak Ridge National Lab., TN (United States). [1992]. 30p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Thermal performance of the exterior envelopes of buildings; Clearwater, FL (United States); 7-10 Dec 1992. Order Number DE92040714. Source: OSTI; NTIS; GPO Dep.

A series of experiments has been completed on the thermal performance of fiberglass and cellulose attic insulations under winter conditions using an attic test module in a guarded hot box facility. Experiments with one type of loose-fill fiberglass insulation showed that the thermal resistance at large temperature differences (70 to 76°F) was about 35 to 50% less than at small temperature differences. The additional heat flow, attributed to natural convection, was effectively eliminated by applying a covering of fiberglass batts or a combination of a polyethylene film and fiberglass blankets. No significant convection was found either with fiberglass batts or with one type of loose-fill cellulose. Using the experimental data along with an attic model, the additional energy costs due to convection in the coldest climate investigated were estimated to be $0.025/ft^{2}yr to $0.028/ft^{2}yr at the R-19 level and $0.014/ft^{2}yr at the R-38 level. For the same conditions, annual energy savings due to upgrading insulation from the R-19 to the R-38 level were estimated to be $0.046/ft^{2}yr to $0.070/ft^{2}yr.

837 (CONF-930118–2) **Laboratory evaluation of an ozone-safe nonazeotropic refrigerant mixture in a Lorenz-Meutzner refrigerator freezer design.** Sand, J.R.; Vineyard, E.A.; Baxter, V.D. Oak Ridge National Lab., TN (United States). [1992]. 32p. Sponsored by USDOE, Washington, DC (United States); Environmental Protection Agency, Washington, DC (United States). DOE Contract AC05-84OR21400. From Winter meeting of the American Society of Heating, Refrigeration and Air Conditioning Engineers; Chicago, IL (United States); 23-27 Jan 1993. Order Number DE92041252. Source: OSTI; NTIS; GPO Dep.

The Lorenz-Meutzner refrigerator freezer (RF) circuit has been proposed as a design which would operate with nonazcotropic refrigerant mixtures (NARMS) and significantly increase the thermodynamic efficiency of household refrigerators. Several ozone-safe and more environmentally acceptable refrigerants are known which could be blended into a NARM to replace R-12 for this domestic refrigeration application. Laboratory tests were performed on a Lorenz-Meutzner (L-M) RF using an R-32/R-124 NARM. Comparisons are made between the baseline performance of the refrigerator with R-12 before it was modified to the L-Ni design and that of the L-M circuit operating with R-12 and the NARM. Circuiting and component changes resulting from initial testing of this unit are described. Computer modeling and compressor calorimeter results for R-12 and the NARM used in the test unit are also presented. Small performance gains (≈ 3%) are seen for the NARM over R-12 in the same refrigerator freezer circuit. Modeling results and steady-state data suggest larger improvements (≈ 15%) are possible. It is felt that the larger improvements predicted from modeling and compressor calorimetry data are not being realized due to poor heat transfer and refrigerant circuiting arrangements.

838 (DEFU-TR–300) **Electricity savings from implementation of standards for the electricity consumption of refr./freezers.** Moeller, J. Danske Elvaerkers Forenings Udredningsafdeling (DEFU), Lyngby (Denmark). Apr 1992. 33p. Order Number DE93721474. Source: OSTI; NTIS.

Also published in Danish as DEFU-TR–300(DA).

An evaluation of the electricity-saving potential of introducing efficiency standards for refrigerators/freezers in the Nordic countries. It is shown that in this way user-economic savings of 25-30% can be achieved in the course of 20 years. The present Nordic consumption with regard to refrigerators in dwellings is ca. 10 TWh. In the reference development (minus efficiency standards) consumption is expected to have been reduced to 7.5 TWh by the year 2010 as a result of the continued expected increase in the energy efficiency of appliances as well as a modest rise in the number of appliances. Electricity consumption is reduced to 5.5, 5 and 4 TWh respectively in the three scenarios. In relation to today's level it is possible to halve consumption at the same time as consumer costs are reduced. Depending on the scenario selected, over a 20 yr. period, the electricity savings amount to 15-35 TWh and the value of these savings amount to between 5 and 12 billion Danish kroner (minus extra cost of efficiency increase). Estimated savings correspond to savings of 225-450 MW in generating capacity at a power plant. The analysis further shows that the effect of standards is modest if they only exclude a limited number of the existing less efficient products on the market. In order to achieve a noticeable effect, in the long term the efficiency standards must be set to a level corresponding to existing low-energy models. (AB).

839 (DEFU-TR–302) **Report on energy consumption related to water beds: Measurements from beds in use and laboratory measurements. (Phase 2 and 5).** Willumsen, O. Danske Elvaerkers Forenings Udredningsafdeling (DEFU), Lyngby (Denmark). Feb 1992. 59p. (In Danish). Order Number DE93721381. Source: OSTI; NTIS.

There are currently ca. 200.000 water beds in Denmark which use a total of 150.000.000 kWh annually, which is about 0.5% of the country's total energy consumption. It has been claimed that a low-energy bed uses about half the amount of energy (750 kWh per year) that a conventional water bed does. The report presents the measurements form the project's 2nd and 5th phase. The conclusion is that where the owners wish to save energy a conventional water bed will consume approx. 2 kWh and a low-energy bed approx. 1 kWh every 24hrs. If the temperature is lowered by 1 degree centigrade, 8-9% of energy consumption can be saved. If the plinth is insulated with plastic globules or crumpled newspapers the energy savings could be 200 kWh per year. The insulation of the wooden sides in a conventional water bed will give a saving of 100 kWh annually. An electronically regulated heating element will result in lowered energy consumption and a more constant temperature. (AB).

840 (DEFU-TR–306) **Electric power savings in the housing sector: Analysis of a 3-year experiment.** Hansen, A.K. Danske Elvaerkers Forenings Udredningsafdeling (DEFU), Lyngby (Denmark). May 1992. 82p. (In Danish). Order Number DE93721478. Source: OSTI; NTIS.

A practical 3-year experiment regarding electricity saving was carried out within the Danish housing sector in cooperation with a number of electric power companies. The publication deals with the third year of this experiment. The aim was to analyse the collected data and to carry out calculations which could be used in connection with net dimensioning, prognoses, decisions regarding tariffs etc. Data is based on the consumers' own reading of their meters, information from electricity bills and the electricity companies' meter readings. Participants also answered questionnaires. The overall aim was to investigate to what extent electricity could be saved without reducing standards of comfort, by influencing consumer habits. The means were provision of information material, consumer meter reading, visits by consultants, increased tariffs and financing arrangements. Only 43% of consumers stayed with the

experiment throughout the three years. The methods used are described and the results of the experiment are presented in detailed tables and graphs. (AB).

841 (DOE/BP–1914) **Energy management in commercial buildings.** Wisconsin Univ., Madison, WI (United States). Aug 1992. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC79-82BP31302. Order Number DE92040930. Source: OSTI; NTIS; GPO Dep.

Energy management involves more than doing a few energy conservation projects. This booklet describes how to set up an energy management program that will help you manage your energy consumption in the same professional way you manage inventory, sales, labor, and other aspects of your business. Since energy management is a relatively new area of concern, it requires conscious effort in the beginning to incorporate it into everyday practice. It is worth the effort, however, since a good energy management program can trim your energy index by 50 percent. The first section of this booklet explains energy management, how it can help your business, and what a successful program looks like. Subsequent sections provide the details of the process. Topics covered include: Energy Management is Good Business, Record Keeping, The Walk-Thru Audit, Energy Conservation Measures, Evaluating Your Program. Rising energy costs put pressure on businesses and make it harder to show a profit. The situation is not likely to improve in the foreseeable future. Hydroelectric power generation, long the mainstay of the Northwest's power system, has peaked. New sources of electricity are costly. Oil is already expensive and natural gas prices will increase as deregulation takes effect. It is reasonable to assume that annual energy costs will continue to increase at a rate several percent greater than. the rate of inflation throughout the 1980s and beyond. On the positive side, electricity rates in the Pacific Northwest are and will continue to be substantially lower than the national average. BPA also projects that, following additional wholesale rate increases through 1985, its rates should stabilize at a level roughly equal to that of 1960 based upon 1980 dollars.

842 (DOE/CE/50274–T1) **Non-inert refrigerant study for automotive applications: Final report, March–December 1990.** Dieckmann, J.T.; Bentley, J.; Varone, A. Little (Arthur D.), Inc., Cambridge, MA (United States). Nov 1991. 75p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AI01-89CE50274. Order Number DE92041034. Source: OSTI; NTIS; GPO Dep.

Alternatives to CFC-12 for automobile air conditioning were examined. The list of candidate fluids included flammable as well as non-flammable substances. HFC-134a was taken as the baseline alternative given current industry plans to convert automobile air conditioning systems to this fluid over the next several years. Three flammable (non-inert) alternative refrigerants – BFC-152a, HC-290 (propane) and HC-270 (cyclopropane) were identified. Air conditioning cycle efficiency, ozone depletion potential, and global warming impacts of these three fluids and HFC-134a were compared, with the three non-inert fluids all having higher COP and lower global warming impact. The ozone depletion potential of each of these fluids is zero. The fire safety implications of the flammable alternatives being used in otherwise conventional automobile air conditioning systems were examined in preliminary fashion. The results, which are subject to more extensive verification indicate that the additional passenger compartment fire risk would be very small, while the incidence of engine compartment fires would increase modestly. The engine compartment fire hazard could be minimized by modest design changes to reduce the occurrence of ignition sources and condenser punctures in front end collisions.

843 (DTH-LV–233) **How important is the location of the room thermostat?.** Madsen, T.L.; Schmidt, T.P.; Helk, U. Danmarks Tekniske Hoejskole, Lyngby (Denmark). Lab. for Varmeisolering. Feb 1990. 10p. Order Number DE93721406. Source: OSTI; NTIS.

This paper describes a test performed in two rooms, one thermally light and the other thermally heavy, in order to investigate the influence of the thermostat location on thermal comfort and on energy consumption. The ability of three thermostat types to maintain a constant equivalent temperature was tested for two different thermostat locations, one traditional location on the wall and the other in the living space close to the center of the room. During each test period the free heat (light and artificial persons) was varied after a preset and repeatable schedule. At two points, close to each of the thermostat locations, the equivalent temperature was recorded. After each test the maximal variation of the equivalent temperature was calculated. The main result was that the temperature variation in the living space can be reduced when the room thermostat is removed from a wall position to a location in the living space. The laboratory test was supplemented with a field test in the Danish Parliament building and the Royal Theater, chosen as two large rooms where the locations of room thermostats are decided for architectural rather than engineering reasons. (au).

844 (HY/SPL-E–6/1991) **Change in energy consumption and the stage in the family life cycle.** Melasniemi-Uutela, H. (Tilastokeskus, Helsinki (Finland)). Helsinki Univ. (Finland). Dept. of Social Psychology. 1991. 45p. (In Finnish). Order Number DE93711151. Source: OSTI; NTIS.

The study examines the changes that occured between 1982 and 1990 in the residential energy consumption of more than 300 households living in single-family houses in Uusimaa province, Finland, with special reference to the connection of the changes with the stage in the family-life cycle. The houses had been completed between 1975 and 1982 and used municipal district heating or direct electric heating. The families' residential energy consumption, as adjusted for weather, rose by 13 per cent on average from 1982-85 to 1989-90. Their water consumption also increased, but the increased energy consumption was mainly due to the increased use of household electricity and heating energy proper. The differences between households concerning the levels of energy and water consumption and the changes in these were only to some extent explained by the stage in the family-life cycle. The connection of different components with the level of consumption and with the change in consumption was considered in detail with respect to families at a standardized stage in the family-life cycle. Families with little change in consumption were usually among those whose initial energy consumption was low. On the other hand families with the biggest rise in consumption were often among those whose initial energy consumption was higher than average. Their level of consumption in 1989-90 was higher than average. The study's most significant result was that the observed trends in change were not universal. The great differences in energy and water consumption between households with the same family structure indicate clearly that the differences were due to differences between the families' life-styles.

845 (LBL–29752) **Using infrared thermography for the study of heat transfer through building envelope components.** Arasteh, D. (Lawrence Berkeley Lab., CA (United States)); Beck, F.; Griffith, B.; Acevedo-Ruiz, M.; Byars, N. Lawrence Berkeley Lab., CA (United States). Nov 1991. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098 ;AI79-86BP63401. (CONF-920108–3: International air conditioning, heating, refrigerating exposition, Anaheim, CA (United States), 25-29 Jan 1992). Order Number DE93000636. Source: OSTI; NTIS; GPO Dep.

Heat transfer through building envelope components is typically characterized by one number, the conductance. Such a characterization is best suited for homogeneous samples since it does not quantify or illustrate spatial variations within a sample. However, the growing use of advanced wall and window insulations with existing framing materials has increased the importance of understanding spatial heat transfer effects within building envelope components. An infrared thermography laboratory has been established to provide detailed quantitative and qualitative information on the spatial heat transfer effects of building envelope materials. The use of this facility for more effective product development and more accurate product development and more accurate product characterization is discussed.

846 (LBL–31562) **California Institute for Energy Efficiency 1991 annual report.** Lawrence Berkeley Lab., CA (United States). [1991]. 37p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. Order Number DE93001569. Source: OSTI; NTIS; GPO Dep.

This 1991 annual report of the California Institute for Energy Efficiency (CIEE) presents current research topics along with institutional events. Various modes for energy conservation are reported including: residential and commercial air distribution systems, thermal energy storage, natural gas and electric powered vehicles, gas-filled thermal insulation panels, exhaust hoods, shade trees and white surfaces, industrial natural gas burners, and lighting systems. (GHH)

847 (LBL–32091) **WINDOW 4.0: Program description. A PC program for analyzing the thermal performance of fenestration products.** Lawrence Berkeley Lab., CA (United States). Mar 1992. 83p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (TA–285). Order Number DE93001468. Source: OSTI; NTIS; GPO Dep.

WINDOW 4.0 is a publicly available IBM PC compatible computer program developed by the Windows and Daylighting Group at Lawrence Berkeley Laboratory for calculating total window thermal performance indices (e.g. U-values, solar heat gain coefficients, shading coefficients, and visible transmittances). WINDOW 4.0 provides a versatile heat transfer analysis method consistent with the rating procedure developed by the National Fenestration Rating Council (NFRC). The program can be used to design and develop new products, to rate and compare performance characteristics of all types of window products, to assist educators in teaching heat transfer through windows, and to help public officials in developing building energy codes. WINDOW 4.0 is a major revision to WINDOW 3.1 and we strongly urge all users to read this manual before using the program. Users who need professional assistance with the WINDOW 4.0 program or other window performance simulation issues are encouraged to contact one or more of the NFRC-accredited Simulation Laboratories. A list of these accredited simulation professionals is available from the NFRC.

848 (LBL–32257) **Building performance analysis using interactive multimedia concepts.** Selkowitz, S.; Beltran, L.; Osterhaus, W.; Papamichael, K.; Schuman, J.; Sullivan, R.; Wilde, M. Lawrence Berkeley Lab., CA (United States). Apr 1992. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-920828–16: American Council for an Energy-Efficient Economy (ACEEE) summer study on energy efficiency in buildings, Pacific Grove, CA (United States), 30 Aug - 5 sep 1992). Order Number DE92041177. Source: OSTI; NTIS; GPO Dep.

We describe LBL's involvement with multimedia concepts by discussing several modules of an advanced computer-based building envelope design tool. The qualitative and quantitative aspects of the building design process are accommodated within the same design tool which uses object-oriented programming procedures. This computer-based concept utilizes images (buildings, landscapes, models, documents, etc.), expert systems (knowledge bases, i.e., lighting design, site planning, HVAC design, etc.), and data bases (design criteria, utility rates, climatic data, etc.) in addition to more traditional simulation models to evaluate building design alternatives.

849 (NEI-DK–946) **Electricity consumption and saving at Fjordskolen, Egvad municipality.** Tarm Elektricitetsvaerk Am/S (Denmark). May 1991 21p. (In Danish). Order Number DE93721435. Source: OSTI; NTIS.

An example of a report in relation to energy consultancy (pilot project) published in connection with "Haandbog i energiraadgivning" (Handbook on energy consultancy), Danske Elvaerkers Forening, 1992.

The aim was to investigate electricity consumption at Fjord school, in Denmark, and potentials for saving electricity. In 1990/91, 242,000 kWh were used, and the cost was 236,000 Danish kroner. The school is heated by district heating and the consumption here was 780,000 kWh, costing 332,000 Danish kroner. Water consumption during this period was 3,200 m^3, costing 45,000 Danish kroner. Two thirds of the school's electricity consumption is used for lighting purposes, the remainder for ventilation, pumps and electronic equipment. It was concluded that substituting fluorescent lamps with low consumption bulbs or discharge lamps would save 27% of electricity consumption, (71,000 Danish kroner p.a.) The consultants also recommended control of district heating consumption which could save 5-10% of energy consumption. A reduction in electricity would also result in a reduction of pollutive emission from the relative power plant it is stated. For every 10,000 kWh electricity saved, emission is reduced (under currently prevailing conditions and where coal is used as fuel) by 55 kg SO_2, 19 kg NO_x, and 11,000 CO_2. (AB) (59 refs.).

850 (NEI-DK–948) **Electricity consumption and savings at the Danish Energy Agency, Landemaerket 9 - 11.** Koebenhavns Belysningsvaesen, Copenhagen (Denmark). Oct 1991 39p. (In Danish). Order Number DE93721434. Source: OSTI; NTIS.

An example of a report in relation to energy consultancy (pilot project) published in connection with "Haandbog i energiraadgivning" (Handbook in energy consultancy), Danske Elvaerkers Forening, 1992.

In 1990 the electricity consumption for the Danish Energy Agency building was 198,000 kWh, costing 168,000 Danish kroner. The building utilizes district heating, here using during the year 1990 - 606 MWh (204,000 Danish kroner). Electricity consumption covers lighting (40%), electronic equipment (33 %), cooling systems (13%), ventilation (4%), and photocopying machines and water heaters (9%). It was reckoned that the agency, after following the recommendations of the consultants, could save 81,000 kWh answering to 29% of the total electricity consumption, which at current prices would mean saving 61,000 Danish kroner. 4,500 Danish kroner could be saved by changing out the fluorescent bulbs. The necessary investment would be 327,000 Danish kroner with a repay period of 5 years. If the computer equipment was also changed out the total saving would be 158,200 kWh p.a. answering to 57% of the agency's total electricity consumption. The consultants recommended the control of electricity and district heating consumption, this would increase overall saving by 5-10%. These electricity savings would also result in a reduction of pollutive emission from coal-fired power plants, currently to the amount of 55 kg SO_2, 19 kg NO_x and 11,000 kg CO_2. (AB).

851 (NEI-DK–951) **Measuring programme for combined solar energy and natural gas heat pump system.** Christensen, H.J.; Brink, A. Aidt Miljoe, Hadsten (Denmark). [1992] 62p. (In Danish). Contract TR-88.196. Order Number DE93721385. Source: OSTI; NTIS.

The aim of the project was to estimate the value of combining an energy absorber with a subsurface storage facility in order to increase the yield and efficiency of a heat pump system. The construction of the system and the measuring programme are described, and the results of the latter are given. Measurements documented that 40% of natural gas otherwised used could be saved in relation to this type of system. The natural-gas-driven heat pump system (60kw) supplied 20 households and a communal building with heat and domestic hot water throughout the year. The heat was distributed by a low temperature district heating system. The heat pump system was supplied with surplus heat from the glass areas that joined the residential buildings to each other. Heat storage took place in pipes laid at a depth of 160 cm under the earth in the communal yard. The mass of earth acted as a heat storage facility for passive solar energy and made it possible for the heat pump to operate at the highest efficiency level throughout the winter months. (AB).

852 (NEI-DK–963) **OLF and energy. Phase 2: OLF values before and after cleaning the ventilation system. Final report on the pilot project.** Pejtersen, J.; Clausen, G.; Fanger, P.O. Danmarks Tekniske Hoejskole, Lyngby (Denmark). Lab. for Varme- og Klimateknik. Aug 1992 66p. (In Danish). Contract ENS-1213/90-0012. Order Number DE93721421. Source: OSTI; NTIS.

EFP-90.

The aim of the project was to investigate the influence of cleaning and retrofitting the ventilation system on the air quality in buildings. The concentration of pollution components in a building is dependent on pollution concentration both in- and outdoors and the rate of ventilation. In order to quantify the pollution concentration it is important to measure both the concentration (in chemical, biological or sensory units) and the flow of outside air throughout the system. It has been found that materials in a room, such as carpets, furniture etc., and even the ventilation system, are often

greater sources of pollution than the people in the room. The introduction of the OLF unit for the strength of a sensory pollution source and the decipol unit for the experienced air quality has made it possible to quantify all the pollution sources in a room. In this case the cleaning of the ventilation system resulted in the dominating sensory pollution source strength for the humidifier, of 216 OLF, being removed. ("OLF", is an abbreviation of the Latin word "olfactus", the sense of smell, and is the unit of measurement of the strength of sensory pollution sources). The cleaning of the ventilation system resulted in a rise in the rate of ventilation by 150%. There was a tendency that the air quality in the rooms was improved after the ventilation system was cleaned. The intensity of most of the symptoms experienced by the employees after cleaning the ventilation system remained about the same. (AB) (31 refs.).

853 (NEI-DK–964) **Need-regulated ventilation - the scientific background: Final report on the research project.** Clausen, G.; Thorstensen, E.; Pejtersen, J.; Fanger, P.O. Danmarks Tekniske Hoejskole, Lyngby (Denmark). Lab. for Varme- og Klimateknik. Jul 1992 116p. (In Danish). Contract EM-1213-702-01-01;Contract EM-1213/87-2. Order Number DE93721420. Source: OSTI; NTIS.

EFP-87.

The aim was to investigate the potentials for energy saving in relation to a need-regulated ventilation system. A series of tests were carried out in connection with the determination of air quality in schools. It is claimed that by utilizing need-regulated ventilation it is possible to achieve energy efficiency without loss of indoor air quality. The principle is to accomodate the amount of inlet air to the actual ventilation need in a room. In such a ventilation system the inlet of outdoor air is controlled by a sensor for a specified pollutant so that the concentration of the chosen pollutant is kept under a specified value. Tests of this system have in some cases shown a reduction in the consumption of energy. Methods and calculations used for the determination of air quality in schools are described and results are presented. Conclusions were that the use of need-regulated ventilation can result in a lower quality of air when the load from the controlling parameters is low, and that the sensorized pollutive sources in the schools investigated were persons (39%), ventilation system (39%) and materials (22%). (AB) (18 refs.).

854 (NEI-DK–965) **Reduction of ventilation needs by cleaning the return air: Final report on the research project.** Clausen, G.; Moeller, S.B.; Fanger, P.O. Danmarks Tekniske Hoejskole, Lyngby (Denmark). Lab. for Varme- og Klimateknik. Jun 1992 41p. (In Danish). Contract EM-1213-504-02-01;Contract EM-1213/85-4. Order Number DE93721419. Source: OSTI; NTIS.

EFP-85.

A detailed description of the dimensioning and construction of an air washer the aim of which is, in relation to indoor pollution, to reduce the odour caused by tobacco smoking, is supplemented by a paper "The Impact of Air Washing on Environmental Tobacco Smoke Odor". This paper was presented at the conference "Indoor Air '87" in Berlin. The main text is richly illustrated with diagrams and numerical data. (AB).

855 (NEI-DK–972) **Energy technology in public swimming baths.** Publikation, 32/1992. Dansk Svoemmebadsteknisk Forening, Taastrup (Denmark). 1992 174p. (In Danish). Order Number DE93721451. Source: OSTI; NTIS.

Energy consumption is high in Danish public swimming baths and so constitutes 40% - 50% of the total operational budget. Statistical data on energy and water consumption gathered from 40 swimming baths are presented in order to illustrate how to set up energy budgets. The publication aims to be a detailed reference book for technicians in relation to projecting, construction and operation of public swimming baths where priority is given to energy conservation. It contains dimensioning criteria with regard to ventilation, the water in the baths, lighting systems and saunas, and in each case advice is given on how to use the least amount of energy. The subject of heat recovery from waste water from the showers, the various means of heating and maintenance and energy control throughout are also discussed with emphasis on energy conservation. (AB) (19 refs.).

856 (NEI-DK–973) **Cooperative housing association Vaarst Vestervang: Preliminary investigations on renewable energy system for sixteen households within a cooperative housing association and experiences gained from the construction phase.** Boelsmand, H. PlanEnergi S/I (Denmark). Aug 1992 38p. (In Danish). Contract TR-89.0584. Order Number DE93721455. Source: OSTI; NTIS.

The building site is located in an agricultural area south-west of the country town of Vaarst in the southern part of the municipal area of Aalborg. The cooperative housing association preferred that heating be provided by a renewable energy source, and that rooms should be heated from under the floor. Ideas from a competition where ideas were offered for heating systems for low energy houses are investigated. The publication presents detailed data on predicted total energy consumption, the proposed energy production systems (individual and district heating systems) and cost benefits. The heating systems dealt with as being feasible comprise wood or straw-fired boilers, individual heat pumps, and solar heating with seasonal storage facilities. Environmental consequences of the various propositions are also presented in the form of tables giving figures for predicted pollutant emissions. (AB).

857 (NEI-DK–975) **Assistance in energy cooperation to the Czechoslovakian energy authorities: Building Sector: Final report.** Energistyrelsen, Copenhagen (Denmark); Statens Byggeforskningsinstitut, Hoersholm (Denmark); Birch og Krogboe Raadgivende Ingenioerkontor, Virum (Denmark). Dec 1991 152p. Order Number DE93721454. Source: OSTI; NTIS.

Sponsored by Commission of the European Communities Directorate-General for Energy XVII/A3.

A study of the possibilities for energy savings in Czechoslovakian buidings, the goal being 30%, is presented. It outlines technical and organizational activities which are prerequisite for achieving this goal. A registration of building stock was carried out in addition to a detailed technical audit conducted in 20 different buildings in Prague and Bratislava and a less detailed collection of data for about 100 other buildings of different categories. On these data energy saving measures were based and a list of priorities was made. Technical recommendation were worked out for energy specifications for revised building regulations for this country. Suggestions for energy saving were optimization of boilers, pipe insulation, radiator valves and metering and roof and facade insulation. It is reckoned that 26%, or 77 PJ can be saved at a total investment of 140 milliard KCS with pay back periods of up to 20 years, based on the world market prices of light fuel oil. Information campaigns could reduce energy consumption by 2-3%. Comprehensive supportive legislation, cost-true prices and new financing offers, short-term courses for engineers and boiler room personnel, an improved transparency of the market and the development of new products via research in addition to a facilitation of interaction with foreign companies are advised. A book of appendices presents detailed data collected during the course of the project. (AB).

858 (NEI-NO–282) **An energy information system for atrium design.** Bryn, I.H. Trondheim Univ. (Norway). Norges Tekniske Hoegskole. 1992 150p. Order Number DE93721638. Source: OSTI; NTIS.

The main topic of this thesis is a presentation and discussion of ISOLDE'S ATRIUM, a computer tool for the design of the energy aspect of atrium buildings. Important issues that are presented are representation of knowledge about the energy aspect of atrium buildings, the capabilities of the simulation tools for atrium buildings and human computer interaction aspects of the system. As an introduction to computer aided building design a presentation is given of some models in the design process and requirements for computer tools to support the design process. One requirement of the design tools is that they should communicate with each other, share data and work on the same model of the buildings. This thesis presents research and standardization work in this area. Examples of existing integrated computer design support tools are also presented. The rest of this thesis presents the structure, the content, the background theory and ideas on user interaction used in ISOLDE'S ATRIUM. ISOLDE'S ATRIUM is a design support system that covers the energy aspect of the design. When fully developed it will contain three parts: General Advice, Simplified

Design Analysis and Detailed Design Analysis. ISOLDE'S ATRIUM is presented by a description of the system structure and a scenario describing an architect using the program. The scenario gives several examples of the information and graphical presentations in the program. Requirements for calculation and simulation programs to study thermal comfort and energy consumption in atrium buildings are presented. 72 refs., 50 figs.

859 (PNL-SA–20288) **Status of state and local adoption of energy standards for new commercial buildings.** Boulin, J.J. (USDOE, Washington, DC (United States)); Conover, D.R. Pacific Northwest Lab., Richland, WA (United States). Sep 1992. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-920828–15: American Council for an Energy-Efficient Economy (ACEEE) summer study on energy efficiency in buildings, Pacific Grove, CA (United States), 30 Aug - 5 sep 1992). Order Number DE92041329. Source: OSTI; NTIS; GPO Dep.

This paper presents a summary of building energy standards adoption by state and major local governments and how the standards apply to new commercial buildings. Numerous public and private sector agencies and organizations develop energy standards and codes for commercial buildings. These documents serve, among others, state and local legislators and regulators who are interested in requiring their use to reduce the energy consumption of new commercial buildings. Through adoption or adaptation of these documents by state or local governments, minimum acceptable design and construction criteria for new commercial buildings are established in law. The energy standard or code adopted, or used as a basis for a state developed standard, may be any one of a number of documents. The authority of the state to regulate construction may apply throughout the entire state, only to a few types of buildings, or may be absent, in which case local government has regulatory authority. The means of adoption may be by legislation, regulation, municipal code, or other legal vehicle. At the present time there are widespread differences in the energy standards adopted by state and local government and the application of these standards to new commercial buildings.

860 (PNL-SA–20804) **Increasing energy efficiency through improved enforcement of building energy codes.** Shankle, D.L.; Lesperance, A.M.; Fowler, R.A. Pacific Northwest Lab., Richland, WA (United States). Apr 1992. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-920828–18: American Council for an Energy-Efficient Economy (ACEEE) summer study on energy efficiency in buildings, Pacific Grove, CA (United States), 30 Aug - 5 sep 1992). Order Number DE93001314. Source: OSTI; NTIS; GPO Dep.

The US Government has developed a series of performance standards to improve the energy efficiency of buildings in the United States. Building code officials are central to the implementation and enforcement of the building energy standards. This paper gives survey results that show that building code officials need additional staff, training, and tools to do their work more effectively.

861 (PNL-SA–20909) **Innovation in manufactured housing energy-efficiency programs.** Onisko, S.A. (USDOE Bonneville Power Administration, Portland, OR (United States)); Lee, A.D. Pacific Northwest Lab., Richland, WA (United States). [1992]. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-920828–11: American Council for an Energy-Efficient Economy (ACEEE) summer study on energy efficiency in buildings, Pacific Grove, CA (United States), 30 Aug - 5 sep 1992). Order Number DE92041341. Source: OSTI; NTIS; INIS; GPO Dep.

The manufactured housing industry has undergone some major changes in the Pacific Northwest. Drafty mobile homes with a reputation for low quality and energy efficiency performance may become a thing of the past thanks to some innovative programs to upgrade manufactured housing sponsored by Northwest utilities and the Bonneville Power Administration. Utilities started paying attention to manufactured housing in the mid 1980s when they learned that up to 50% of new houses sited in their areas were manufactured homes. Preliminary studies indicated that huge energy savings were possible in these homes, more than 50% over the life of the home! Bonneville's first coordinated effort to study the situation was the Manufactured Housing Work Group which was established in the fall of 1986 and included manufacturers, utilities, the Northwest Power Planning Council, Pacific Northwest Laboratory (PNL), trade associations, and regulatory agencies. The Work Group recommended energy programs for manufactured housing based on Bonneville's conservation programs for site-built homes: the Super Good Cents Program (SGC) and the Residential Construction Demonstration Project (RCDP). Research results from the RCDP/SGC Manufactured Housing Program included collection of metered energy end-use data and cost data on individual conservation measures, cost effectiveness analyses, and computer modeling. This research is giving Bonneville the data it needs to recommend the best tactics for keeping the manufactured housing industry on its newfound course of energy efficiency, a direction that is sure to mean higher quality homes for the consumer and energy savings for regional utilities.

862 (PNL-SA–20976) **Relighting for energy efficiency and productivity.** Harris, L. (USDOE, Washington, DC (United States)); Purcell, C.W. Pacific Northwest Lab., Richland, WA (United States). [1992]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-920828–13: American Council for an Energy-Efficient Economy (ACEEE) summer study on energy efficiency in buildings, Pacific Grove, CA (United States), 30 Aug - 5 sep 1992). Order Number DE92041336. Source: OSTI; NTIS; GPO Dep.

This paper presents an overview of the process and approach of the Federal Relighting Initiative (FRI). It describes the major steps in relighting Federal buildings for energy efficiency and increased productivity.

863 (PNL-SA–21019) **Analysis of end-use electricity consumption during two Pacific Northwest cold snaps.** Sands, R.D. Pacific Northwest Lab., Richland, WA (United States). [1992]. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-920828–12: American Council for an Energy-Efficient Economy (ACEEE) summer study on energy efficiency in buildings, Pacific Grove, CA (United States), 30 Aug - 5 sep 1992). Order Number DE92041337. Source: OSTI; NTIS; GPO Dep.

The Pacific Northwest has experienced unusually cold weather during two recent heating seasons. Hourly end-use load data was collected from a sample of residential and commercial buildings during both cold snaps. Earlier work documented the changes in end-use load shapes as outdoor temperature became colder. This paper extends analysis of cold snap load shapes by comparing results from both cold snaps, exploring the variability of electricity consumption between sites, and describing the use of load shapes in simulating system load. Load shapes from the first cold snap showed that hot water use shifted to later in the morning during extremely cold weather. This shift in load also occurred during the second cold snap and is similar to the shift observed on a typical weekend. Electricity consumption averaged across many sites can mask widely varying behavior at individual sites. For example, electricity consumption for space heat varies greatly between homes, especially when many homes are able to burn wood. Electricity consumption for space heat is compared between a group of energy-efficient homes and a group of older homes.

864 (VTT/LVIS2000–1) **Indoor climate seminar.** Seppaenen, O. (ed.) (Helsinki Univ. of Technology, Otaniemi (Finland). Lab. of Heating and Ventilation). Technical Research Centre of Finland, Espoo (Finland). Lab. of Heating and Ventilation. 1989. 168p. (In Finnish). (CONF-8909491–: Conference on climate and water, Helsinki (Finland), 11-15 Sep 1989). Order Number DE93721586. Source: OSTI; NTIS.

LVIS-2000 Research Programme.

The national energy research programme LVIS-2000: Future Building Services is concerned with the control of energy use and indoor climate in buildings of the future. The projects were presented at a one day seminar arranged by the Laboratory of Heating and Ventilation of the Technical Research Centre in Finland which is coordinating the programme. The presentations at the seminar were: Impurity emission from materials, Building materials and indoor air quality, analysis of organic compounds in

indoor air, effect of the return air, effect of the return air on health and comfort, electric heating as an indoor climate factor, calculations of air flows in ventilated rooms, effect of energy saving measures on hospital hygiene, application of modern aerosol measurement technique on indoor climate research.

865 (VTT/LVIS2000–4) **Building automation seminar.** Katajisto, K. (ed.). Technical Research Centre of Finland, Espoo (Finland). Lab. of Heating and Ventilation. 1990. 245p. (In Finnish). (CONF-9003332–: Seminar on building automation, Espoo (Finland), 8 Mar 1990). Order Number DE93721587. Source: OSTI; NTIS.

LVIS-2000 Research Programme.

The national energy research programme LVIS-2000: Future Building Services is concerned with the control of energy use and indoor climate in buildings of the future. The projects were presented at a one day seminar arranged by the Laboratory of Heating and Ventilation of the Technical Research Centre in Finland which is coordinating the programme. The presentations were focused on following topics: BEMS (Building and Energy Management Systems) in the future, Automation design and user interfaces, A general model for building automation, Control of room temperature, design of interfaces for building automation and simulation of control for air conditioning systems.

866 (VTT/LVIS2000–6) **Indoor climate seminar.** Seppaenen, O. (ed.) (Helsinki Univ. of Technology, Otaniemi (Finland). Lab. of Heating, Ventilation and Air Conditioning). Technical Research Centre of Finland, Espoo (Finland). Lab. of Heating and Ventilation. 1990. 197p. (In Finnish). (CONF-9006427–: Seminar on indoor climate, Espoo (Finland), 7 Jun 1990). Order Number DE93721588. Source: OSTI; NTIS.

LVIS-2000 Research Programme.

The national energy research programme LVIS-2000: Future Building Services is concerned with the control of energy use and indoor climate in buildings of the future. The projects were presented at a one day seminar arranged by the Laboratory of Heating and Ventilation of the Technical Research Centre in Finland which is coordinating the programme. The topics presented at the seminar were: The effect of indoor air on health in office buildings, The effect of air temperature on performance of office work, Emissions from building and interior materials, Experiences of odour panels in indoor climate research, Mould spores and bacteries in the indoor air of rural houses, Ventilation systems in future buildings, Demonstration project of ventilation systems in a block of flats.

867 (VTT/LVIS2000–7) **Energy systems in buildings.** Nyman, M. (ed.). Technical Research Centre of Finland, Espoo (Finland). Lab. of Heating and Ventilation. 1990. 222p. (In Finnish). (CONF-9004368–: Seminar on energy systems in buildings, Espoo (Finland), 26 Apr 1990). Order Number DE93721589. Source: OSTI; NTIS.

LVIS-2000 Research Programme.

The national energy research programme LVIS-2000: Future Building Services is concerned with the control of energy use and indoor climate in buildings of the future. The projects were presented at a one day seminar arranged by the Laboratory of Heating and Ventilation of the Technical Research Centre in Finland which is coordinating the programme. The presentations were focused on following topics: Future cooling systems in Finland, Heating and cooling by absorption, A new central water-based heating, Electric heating in large buildings, Evaluation of the performance of the HVAC equipment in buildings, Infrared switching for controlling the lighting.

868 **Water heater bottom insulation member.** Lewis, B. 28 Jul 1992. Filed date 27 Feb 1992. Canada Patent patent application 2062015. 13p. Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN.

A rigid insulation member fits internally at the bottom end of a water heater having an inner tank with an upwardly concave base and an outer shell separated by an insulation gap from the inner tank. The insulation member has a one piece construction comprising an upwardly convex center portion which mates with the concave base of the inner tank, a peripheral ring which spans the insulation gap, and an annular channel between the center portion and the peripheral ring which seats the inner tank of the water heater such that it sits essentially vertically within the water heater. The insulation material used in making the insulation member of the invention should be able to keep its shape when the tank is placed upon it. A product sold under the trade name of Styropour is particularly suitable, but other types of materials and in particular expanded foam materials can be used in forming the insulation member. 3 figs.

3202 Transportation

Refer also to citation(s) 790, 887, 900, 1767, 1770, 1771, 1772

869 (ANL/CP–76181) **US maglev: Status and opportunities.** Coffey, H.T. Argonne National Lab., IL (United States). [1992]. 6p. Sponsored by Department of Transportation, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-920802–10: Applied superconductivity conference, Chicago, IL (United States), 23-28 Aug 1992). Order Number DE92041132. Source: OSTI; NTIS; GPO Dep.

Recognizing the development of maglev systems in Germany and Japan, and the growing congestion, air pollution and energy consumption resulting from our current transportation system, the United States, in 1990, embarked on a program to evaluate the potential usefulness of these systems in the US. In this paper, the utility of maglev systems in alleviating some of these problems, progress in the current program, and opportunities for participation by the superconductivity and cryogenic communities are discussed.

870 (ANL/CP–77116) **Dynamic stability of maglev systems.** Cai, Y.; Chen, S.S.; Mulcahy, T.M.; Rote, D.M. Argonne National Lab., IL (United States). [1992]. 58p. Sponsored by Department of Defense, Washington, DC (United States); Department of Transportation, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9210176–1: 63. shock and vibration symposium, Las Cruces, NM (United States), 27 Oct 1992). Order Number DE92041104. Source: OSTI; NTIS; GPO Dep.

Since the occurrence of dynamic instabilities is not acceptable for any commercial maglev systems, it is important to consider the dynamic instability in the development of all maglev systems. This study is to consider the stability of maglev systems based on experimental data, scoping calculations and simple mathematical models. Divergence and flutter are obtained for coupled vibration of a three-degree-of-freedom maglev vehicle on the guideway which consists of double L-shaped aluminum segments attached to a rotating wheel. The theory and analysis developed in this study provides basic stability characteristics and identifies future research needs for maglev system.

871 (LBL–32384) **Trends in transportation energy use, 1970–1988: An international perspective.** Schipper, L.; Steiner, R.; Meyers, S. Lawrence Berkeley Lab., CA (United States). May 1992. 31p. Sponsored by Environmental Protection Agency, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-9108137–4: Asilomar conference on transportation and global climate change: long range options, Pacific Grove, CA (United States), 25-28 Aug 1991). Order Number DE92041166. Source: OSTI; NTIS; GPO Dep.

Personal mobility and timely movement of goods have become increasingly important around the world, and energy use for transportation has grown rapidly as a consequence. Energy is used in transportation for two rather different activities: moving people, which we refer to as passenger travel, and moving freight. While freight transport is closely connected to economic activity, much of travel is conducted for personal reasons. In the OECD countries, travel accounts for around 70% of total transportation energy use. In contrast, freight transport accounts for the larger share in the Former East Bloc and the developing countries (LDCs). In our analysis, we focus on three elements that shape transportation energy use: activity, which we measure in passenger-km (p-km) or tonne-km (t-km), modal structure (the share of total activity accounted for by various modes), and modal energy intensities (energy use per p-km or t-km). The modal structure of travel and freight transport is

important because there are often considerable differences in energy intensity among modes. The average 1988 average energy use per p-km of different travel modes in the United States (US), West Germany, and Japan are illustrated. With the exception of rail in the US, bus and rail travel had much lower intensity than automobile and air travel. What is perhaps surprising is that the intensity of air travel is only slightly higher than that of automobile travel. This reflects the much higher utilization of vehicle capacity in air travel and the large share of automobile travel that takes place in urban traffic (automobile energy intensity in long-distance driving is much lower than the average over types of driving).

872 (NEI-DK–974, pp. 27-33) **Public transport and the economy.** Holmberg, B. (Transportforskningsberedningen, Stockholm (SE)). Hovedstadsraadets Trafikselskab, Valby (Denmark); Trafikministeriet, Copenhagen (Denmark). 1992. 96p. (In Swedish). (CONF-9204202–: Conference on traffic, Humlebaek (Denmark), 10 Apr 1992). In *Traffic at Louisiana: Contributions to the conference.* Order Number DE93721449. Source: OSTI; NTIS.

For persons using the road, travel time, convenience and price are important factors. The car has certain advantages that public transport cannot offer. On average it takes 83 minutes to go by public transport in a city like Stockholm. If you go by car, the same journey takes 47 minutes. The biggest problem for all road users - apart from pollution - is the congestion of the cities. Because of the longer travelling time when using public transport, the congestion is not so serious as to make people give up the car, also despite the fact that buses and trains are much safer than cars. If we look at the number of persons killed in traffic accidents, it is approx. 10 times safer per passenger kilometre to go by bus or train. If cars and buses on the one hand are compared with trains on the other, the train has a structural effect which the other means of transport have not. A railway affects the building pattern; often a concentration of dwellings is seen near it. This gives the railway a competitive edge, since the bus does not have this structural effect. Despite the fact that cars have certain advantages vis-a-vis public transport, the congestion, safety factor and environmental issues will cause a growing number of people to use public transport - particularly so, if this means of transport is improved to be able to compete against the car. (au).

873 (NEI-DK–974, pp. 57-61) **Why is it that people do not choose public transport?.** Norheim, B. (Socialoekonomisk Institut, Oslo (NO)). Hovedstadsraadets Trafikselskab, Valby (Denmark); Trafikministeriet, Copenhagen (Denmark). 1992. 96p. (In Norwegian). (CONF-9204202–: Conference on traffic, Humlebaek (Denmark), 10 Apr 1992). In *Traffic at Louisiana: Contributions to the conference.* Order Number DE93721449. Source: OSTI; NTIS.

Baard Norheim points to the fact that public transport in Norway has declined between 1982-89, despite the fact that there are a long string of socio-economic reasons why public transport should be preferred in cities. Based on the public transport system in Zurich, where 6.4 billion has been invested in the public transport system, Baard Norheim underlines what framework conditions have to be fulfilled for the public transport measures to have the right effect. (au).

874 (NEI-DK–974, pp. 63-67) **Urban environment and transport must always go hand-in-hand.** Hurup, N. (Sven Allan Jensens Tegnestue, Aalborg (DK)). Hovedstadsraadets Trafikselskab, Valby (Denmark); Trafikministeriet, Copenhagen (Denmark). 1992. 96p. (In Danish). (CONF-9204202–: Conference on traffic, Humlebaek (Denmark), 10 Apr 1992). In *Traffic at Louisiana: Contributions to the conference.* Order Number DE93721449. Source: OSTI; NTIS.

Transport and urban environment should not be seen as separate issues, but rather be combined in municipal planning so as to avoid unfortuante mixtures of over-dimensioned and esthetically hasty traffic installations and unattractive architecture. Urban environment and transport planning must be redefined from being rationalistic planning with functionally separated cities to covering the integration of the visual environment, esthetics, architectural unity and environmental sustainability. There should be no more piecemeal traffic renovation projects, but rather an overall formulation of issues, looking at the city as a whole and starting by looking at energy consumption, environmental nuisances, traffic area layout and the unfortunate examples relating to cityscapes, i.e. buildings and open areas. On this basis a prioritized action plan is then made. Efforts should be made to obtain the greatest possible effect with the smallest possible amount of money. In such an action plan, citizens should be actively involved, and the general level of information should be increased. Professional-ideological barriers should be overcome, and the way should be paved for the political and economic will to change planning methods. In municipalities and cities attitudes are slowly changing in urban policy and planning. However, there is still a lot of ground to be covered. The funding of measures to improve the environment and the traffic situation should be provided on the same lines as the government support given through urban renewal schemes. (au).

875 (NEI-DK–974, pp. 75-77) **Transport model for the metropolitan region and development trends in transport.** Larsen, F. (Ingenioerfirmaet Anders Nyvig A/S, Hoersholm (DK)). Hovedstadsraadets Trafikselskab, Valby (Denmark); Trafikministeriet, Copenhagen (Denmark). 1992. 96p. (In Danish). (CONF-9204202–: Conference on traffic, Humlebaek (Denmark), 10 Apr 1992). In *Traffic at Louisiana: Contributions to the conference.* Order Number DE93721449. Source: OSTI; NTIS.

In his presentation, Flemming Larsen describes the expected development of passenger transport in Metropolitan Copenhagen within the next 20-25 years, depending on the planning policy pursued. The starting point for his intervention is the work of the Wuertzen Committee on a strategic transport model, i.e. a model that tries to describe passenger transport in some main corridors and ring connection in Metropolitan Copenhagen. The model operates with a relatively rough zoning, corresponding to the urban and transport structure and computes how many people need to commute between these zones. The model has been used especially to look at transport consequences of industrial developments i Copenhagen. Different strategies for industrial development and siting have been examined and are characterized by stagnation, scattered growth, central growth (i.a. Oerestad) and central growth with special environmental considerations (i.a. a substantial extension of public transport services and the introduction of a road tax for private vehicles). (au).

876 (NEI-DK–974, pp. 85-88) **How can the environmental load of the transport sector be influenced?.** Keiding, H. (Oekonomisk Institut, Koebenhavn Universitet (DK)). Hovedstadsraadets Trafikselskab, Valby (Denmark); Trafikministeriet, Copenhagen (Denmark). 1992. 96p. (In Danish). (CONF-9204202–: Conference on traffic, Humlebaek (Denmark), 10 Apr 1992). In *Traffic at Louisiana: Contributions to the conference.* Order Number DE93721449. Source: OSTI; NTIS.

According to Hans Keiding, local public transport has been hit by three classic types of market failure: the car - the natural competitor to public transport - has a high negative impact on the surrounding environment, but is nevertheless both quicker and cheaper as a means of transport; the product - local public transport - has an aura of being a public good (buses always run, no matter how many or few people use them, which implies economic waste); and in production terms it is characterized by growing economies of scale (public transport stands for a high investment cost and comparatively modest operating cost). Local public transport is thus a trade which cannot be left to the powers of a free market economy without leading to substantial waste. Hans Keiding offers ways of remedying market failure. One of the ways is to use taxes and subsidies as regards the production that puts limits on the activities of local public transport. Another way is to look at the idea of public transport as being a public good, where payment is made according to the marginal utility value for the individual or the individual's willingness to pay, and thirdly that the need for making a profit is eliminated. As regards new tracks of research, Hans Keiding proposes to give much higher priority to researching the question of payment for public transport. "After all, transport is not only a question of traditional engineering skills; economics should also supply high-technology answers for tomorrow's transport systems". (au).

877 (NEI-DK–974, pp. 89-92) **Transport requirements and resource costs.** Hvashoej Joergensen, C. (COWI consult, Lyngby

(DK)). Hovedstadsraadets Trafikselskab, Valby (Denmark); Trafikministeriet, Copenhagen (Denmark). 1992. 96p. (In Danish). (CONF-9204202–: Conference on traffic, Humlebaek (Denmark), 10 Apr 1992). In *Traffic at Louisiana: Contributions to the conference.* Order Number DE93721449. Source: OSTI; NTIS.

Over the last 20 years transport requirements have grown in proportion with the growth of the economy. This has not been the case for other energy consuming sectors, where it has been possible in connection with the energy crises to break the linkage between energy consumption and production. One of the reasons for this may be that some of the technological progress made in the transport sector has been offset by higher performance requirements. The environmental problems of the transport section in the period until the year 2030 do not seem to frightening at first glance, since the result is not much above the 1988 level. However, the goals established with regard to energy and CO_2 emissions mean that energy consumption and emissions must be cut by half compared with the 1988 level. This is where the problem lies buried. It will take dramatic measures to reach these goals. One example is that a change of behaviour will be needed from transport organisations and transpfort users. Furthermore, resource costs will have to be included in transport policy and sector planning. The inclusion of environment costs in the decision-making process was illustrated by means of three examples. These examples were taken from the transit transport in Switzerland and Austria, roads versus railways in Eastern and Western Europe, and alternative propellants for buses. (au).

878 (ORNL/TM–12188) **Technical documentation for the 1990 Nationwide Truck Activity and Commodity Survey Public Use File.** Oak Ridge National Lab., TN (United States). Sep 1992. 137p. Sponsored by Department of Transportation, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93001523. Source: OSTI; NTIS; GPO Dep.

The Nationwide Truck Activity and Commodity Survey (NTACS) provides detailed activity data for a sample of trucks covered in the 1987 Truck Inventory and Use Survey (TIUS) for days selected at random over a 12-month period ending in 1990. The NTACS was conducted by the US Bureau of the Census for the US Department of Transportation (DOT). A Public Use File for the NTACS was developed by Oak Ridge National Laboratory (ORNL) under a reimbursable agreement with the DOT. The content of the Public Use File and the design of the NTACS are described in this document.

3203 Industrial and Agricultural Processes

Refer also to citation(s) 93, 94, 101, 759, 760, 782, 785, 796, 800, 837, 846, 899, 1174, 1199, 1283, 1284

879 (ANL/CP–76897) **Recycling hydrogen and sulfur by microwave chemical processing.** Harkness, J.B.L.; Doctor, R.D. Argonne National Lab., IL (United States). [1992]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9209186–2: Conference for southern states on waste minimization, pollution prevention and environmental regulations, Biloxi, MS (United States), 22-24 Sep 1992). Order Number DE92040744. Source: OSTI; NTIS; GPO Dep.

A waste-treatment process is being developed that recovers both hydrogen and sulfur from hydrogen sulfide-contaminated industry waste. The proposed process uses microwave energy to initiate plasma-chemical reactions that dissociate hydrogen sulfide into elemental hydrogen and sulfur. Using a reaction scheme that recovers a hydrogen product has several advantages over the current Claus technology that burns the hydrogen to water. Both processes produce a clean sulfur product that can be recovered and sold. However, the microwave process produces a gaseous stream that is purified and then separated into streams containing the product hydrogen, hydrogen sulfide for recycle to the plasma-chemical reactor, and the process purge containing carbon dioxide and water. Experiments with pure hydrogen sulfide at flow rates of 0.5–1.5 L/min and microwave powers of 400–1,000 W had previously confirmed that conversions of over 90% per pass are possible. Experiments with impurities typical of petroleum refinery waste hydrogen sulfide streams have demonstrated that these impurities are compatible with the plasma dissociation process and that they do not appear to create new waste treatment problems. Later experiments showed that the cyclonic-flow pattern hypothesized by the Russian theoretical analysis of the plasma-chemical process can substantially decrease hydrogen sulfide dissociation energy requirements while increasing conversion. This technology has a long-term potential for saving $500 million to $1,000 million annually in the refining industry.

880 (CONF-9202133–, pp. 403-420) **Glass furnace efficiency evaluation through three-dimensional modelling.** Graca Carvalho, M. da (Instituto Superior Tecnico, Technical Univ. of Lisbon (Portugal)); Nogueira, M. Fachinformationszentrum Karlsruhe, Gesellschaft fuer Wissenschaftlich-Technische Information mbH, Eggenstein-Leopoldshafen (Germany); Commission of the European Communities, Brussels (Belgium). Directorate General for Energy. 1992. 464p. From European seminar on improved technologies for the rational use of energy in the glass industry - a Thermie programme action and exhibition; Wiesbaden (Germany); 4-6 Feb 1992. In *Improved technologies for the rational use of energy in the glass industry. Proceedings.* Order Number DE93702415. Source: OSTI; NTIS (US Sales Only).

The complex interactions between the several phenomena occurring in the several parts of the furnace entails the appearance of numerical procedures able to predict whole furnace (combustion chamber batch and glass tank) by an integrated way. Such modelling approach was followed in the present work. A three-dimensional mathematical model describing the physical phenomena occurring in a glass melting furnace has been developed. This model is based on the solution, through a finite difference/finite volume technique, of conservation equations for mass, momentum, energy and combustion related species, and comprises two main submodels which correspond to the combustion chamber and glass tank domains. The combustion chamber model incorporated physical modelling for the turbulent combusting flow, soot and thermal radiation. In the second domain the glass tank flow, the model deals with the laminar buoyancy driven radiation transfer inside the glass bulk and radiative exchanges between the glass and surrounding surfaces. For air bubbling effect was calculated through a lagrangean formulation which accounts heat and momentum transfer between the disperse bubbles flow and the glass-melt. (orig.).

881 (DOE/CH/10093–123) **Surface-modification technology for scrap tire reuse: A technical brief.** National Renewable Energy Lab., Golden, CO (United States); Energetics, Inc., Columbia, MD (United States). Sep 1992. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-83CH10093 ;AC01-87CE40762. Order Number DE92001179. Source: OSTI; NTIS; GPO Dep.

This technical briefing report describes the DOE-Air Products project to develop the surface-modification technology for scrap tire rubber. It introduces the technology; discusses the project history, status, and feasibility studies; and reviews the potential benefits of the technology with respect to energy use and economics. Preliminary analyses indicate energy savings of approximately 60,000 Btu/lb by substituting surface-modified rubber in polyurethane systems.

882 (DOE/ID/12624–2) **The smelting of taconite to produce ferrosilicon: Phase 3, Task 1: Final report, [April 1991–December 1991].** Dosaj, V.D. Dow Corning Corp., Midland, MI (United States). Feb 1992. 69p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-87ID12624. Order Number DE93000907. Source: OSTI; NTIS; GPO Dep.

Ferrosilicon is conventionally produced by carbothermic reduction of quartz in presence of steel scrap in large open submerged-arc furnaces. This process produces an off-gas, primarily carbon monoxide, which is usually lost by combustion above the bed of raw materials. A 1.2 MW closed, dc furnace located at SCRA's test facility at Charleston, SC was used to demonstrate the feasibility of producing ferrosilicon using taconite tailiags and coke breeze. Taconite tailings, a byproduct of the iron ore concentration process, contain approximately 65% SiO_2 and 20% Fe. Ferrosilicon containing approximately 40% silicon was produced. The raw material feed was added primarily through the hollow electrode. Three tests in the closed, dc plasma furnace provided experience and data for assessing the carbothermic reduction of taconite tailings. Coke

breeze, as the primary source of carbon, and taconite tailings were introduced into the closed furnace through the hollow electrode. The feed was also introduced through a feed port located on top of the furnace cover. Although the feasibility of smelting taconite tailings to produce ferrosilicon was successfully demonstrated, three problems worthy of note experienced during the runs were: The frequent blockage of the off-gas pipe, material blockages in the system that put charge into the furnace through the hollow electrode, and excessive wear on the furnace roof refractories. The first two problems were successfully resolved. Several off-gas pipes were designed, fabricated, and evaluated. Once the offgas system was functional, sustained feed delivery through the hollow electrode was demonstrated. A slag cover as noted in one of the tests to shield the roof from the arc and water cooling of the roof should eliminate excessive wear of the refractories.

883 (EUR–13089) **Pyrolytic combustion installation of textiles wastes with energy recovery.** Paganelli, M. Commission of the European Communities, Luxembourg (Luxembourg). 1991. 33p. (In French). Contract BM/009/84 IT. Source: OSTI; NTIS (US Sales Only).

Technical and economical results of a sixth months campaign on a pyrolytic combustion installation for various textile fibers wastes (2.000 kg/day) are presented. Heat recovery by an oil heat exchanger and smoke treatments are comprised in the process. (A.B.). 2 figs., 7 tabs.

884 (EUR–14020) **Reduction of energy consumption in the washing process of textile fabrics by advanced technology.** Heidemann, G.; Farber, P.; Ravensbergen, D.W.; Bilkert, R.B.; Boer, J.J. de; Holweg, R.B.M.; Van Overmeire, F.; Reed, C.M. Commission of the European Communities, Luxembourg (Luxembourg). 1992. 123p. Contract EN3E-0113-UK. Source: OSTI; NTIS (US Sales Only).

The purpose of the project presented is to develop, on the basis of sound chemical engineering knowledge, a more energy efficient, open-width fabric washer for the textile industry. A survey of existing washers has highlighted the considerable energy losses from open machines, particularly at the nips between tanks, and an early conclusion is that washers should be fully enclosed. Remaining opportunities centre around water/water heat recovery and optimisation of water flow and temperature. For the latter, a combination of laboratory studies and mathematical modelling, particularly of pressure/suction washing and multiple squeeze/roller washing, has been used to elaborate the possibilities. Suction washing emerges as the more effective method, but the complexity and cost of implementation in a suitably distributed manner, with present conceptions, weighs heavily against it. This still leaves refinements of multiple squeeze roller washing as a major contender. Effort continues to resolve the choice of best method, maintaining due regard for commercial acceptability. (author). refs., figs., tabs.

885 (EUR–14136) **Assessment of incineration of industrial wastes. Demonstration projects.** Maniatis, K. Commission of the European Communities, Luxembourg (Luxembourg). 1992. 106p. Source: OSTI; NTIS (US Sales Only).

This report contains the findings of a study which evaluates projects on direct combustion (informations on incineration and incinerators technology) of industrial wastes (wastes description and characteristics) from wastes of the energy demonstration programme of the Commission of the European Communities. (A.B.). 14 refs., figs., tabs.

886 (EUR–14254) **Composting and compost quality assurance criteria.** Jackson, D.V.; Merillot, J.M.; L'Hermite, P. (eds.). Commission of the European Communities, Luxembourg (Luxembourg). 1992. 433p. (CONF-9109436–: Workshop on Composting and Compost Quality Assurance Criteria, Angers (France), 11-13 Sep 1991). Source: OSTI; NTIS (US Sales Only).

Separate abstracts were prepared for the 29 papers of this volume.

887 (HY/SPL-E–7/1992) **The impact of the changes in the distribution system and the role of the consumer on energy consumption.** Kasanen, P.; Savolainen, M. Helsinki Univ. (Finland). Dept. of Social Psychology. 1992. 107p. (In Finnish). Order Number DE93711152. Source: OSTI; NTIS.

The purpose of the study is to analyze the distribution chain of foodstuffs and the role of the consumer as a part of the chain in terms of energy inputs. Connections between the change of the structure of the distribution system and the change in energy consumption are looked for. Attention is paid to the energy consumption shares of the different parts of the distribution chain. as well as to the development of each part as the system changes. The entire distribution chain is focused on from factory to consumer. The results concerning energy consumption are only rough approximations, due to unsatisfactory data and several assumptions in calculations.

888 (KCP–613-4831) **Process waste assessment methodology development to improve waste minimization.** Pemberton, S.E. Allied-Signal Aerospace Co., Kansas City, MO (United States). Kansas City Div. Aug 1992. 228p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00613. Order Number DE93001257. Source: OSTI; NTIS; GPO Dep.

This project was initiated to determine the methodology of process waste assessments (PWAS) and to develop departmental Pollution Prevention Plans at the Kansas City Division of Allied-Signal Inc. A process waste assessment is a systematic approach to perform material balances around processes which generate waste (hazardous and nonhazardous); to identify waste minimization opportunities; to evaluate those opportunities for technical, safety, and cost feasibility, to establish a baseline to monitor the progress of waste minimization; and to accumulate data to satisfy federal, state, and local Environmental, Safety, and Health (ES&H) reporting requirements. Implementation of Pollution Prevention (PP) and PWA activities at the KCD was organized through six major business units. To establish the PWA methodology, eight pilot projects were selected for completion and evaluation. The evaluation of the pilot PWAs resulted in the following accomplishments: lessons learned, PWA Guidance and worksheet revisions, final report format and minimum requirements, identification of training needs, suggestions for an activity index to normalize the waste data to production, "De minimis" criteria, PWA approach in laboratories, and independent audit of the pilot PWAs and Guidance. Also, the PWA team activities led to the development of a Model Departmental Pollution Prevention Plan for a manufacturing department This plan was distributed to other business units to satisfy a requirement from DOE Order 5400.1.

889 (NEDO-ITE–9109) **Survey on CO_2 disposal method using salt groundwater.** New Energy and Industrial Technology Development Organization, Tokyo (Japan). Mar 1992. 98p. (In Japanese). Sponsored by New Energy and Industrial Technology Development Organization, Tokyo (Japan). Order Number DE93723973. Source: OSTI; NTIS.

The paper surveys the technology of a long-term CO_2 storage in underground aquifers of the salt groundwater which cannot be used in the present condition. In this method, used is CO_2 dissolving power which water has. Among petroleum and natural gas accumulation traps, there are a number of unproductive traps including nothing but the water phase. The world's CO_2 potential storage is estimated, making the depth for CO_2 deposition 2000-3000m and assuming from geographical, geological and economic conditions that the potential deposition area is 1% of all the area of sedimentary basins. The estimation result shows that the world's CO_2 potential storage is 320 billion tons-CO_2 which is equal to the world's 15-year CO_2 emissions. In a plant with a CO_2 treatment capacity of 5000tons/day, the cost is 3000yen/ton-CO_2. Energy required for underground CO_2 deposition is 73 kWh/ton-CO_2. This indicates that the method is viable on an economical basis. However, it is necessary to elucidate behaviors of CO_2 under the ground. It is desirable to expand the range of application of this method little by little, placing emphasis on evaluation of environmental effects. 50 refs., 28 figs., 11 tabs.

890 (NEI-DK–947) **Electricity consumption and savings at Dan-Industri Ltd.** NESA A/S, Hellerup (Denmark). Mar 1991 43p. (In Danish). Order Number DE93721433. Source: OSTI; NTIS.

An example of a report in relation to energy consultancy (pilot project) published in connection with "Haandbog i energiraadgivning" (Handbook on energy consultancy), Danske Elvaerkers Forening, 1992.

During 1990, the Danish firm Dan-Industri used 10,287,000 kWh of electricity, costing 4,729,000 Danish kroner. The firm also used 31,100,000 kWh natural gas (2,388,000 Danish kroner) and 370,000 m^3 of water (3,412,000 Danish kroner). Production machines used 37% of the total electricity consumption, use of compressed air accounted for 23%, ventilation systems 14%, lighting 13%, filtering systems 12% and computer equipment 1%. The use of compressed air, the ventilation lighting and filtering systems were considered as covering the area which had the greatest potential for energy saving and were consequently selected for detailed investigation, although it was recommended to examine the production machines and computer equipment at such a time when the purchasing of new equipment was under consideration. There were 11 suggestions regarding methods of saving electricity which should save 1,000,000 kWh p.a. This saving would constitute 16% of of the investigated consumption and 10% of Dan-industri's total electricity consumption. Necessary investment would amount to 420,000 Danish kroner and a repay period of 1.1 years. The recommendations are elaborated in detail and numerical data support their feasibility. (AB).

891 (NEI-DK–949) **Analysis and optimization of industrial processing systems: A handbook on energy-technological analysis.** Sandvig Nielsen, J.; Weel Hansen, M. DK-Teknik, Soeborg (Denmark). 1992 53p. (In Danish). Contract ENS-1223/90-0007. Order Number DE93721438. Source: OSTI; NTIS.

EFP-90.

Throughout recent years a number of research projects have been carried out under the auspices of the Danish Ministry of Energy with the aim of trying out various methods for analysing and optimizing industrial processing systems. The aim of the handbook is to describe relevant techniques in a way that will result in the reader being eventually able to put some of the methods into practice. The focus is on methods which are easily converted to actual energy analyses, namely the "Pinch" method and static modelling. Basic principles for the analysis of thermal systems and a short guide to exergy analysis is given together with an illustrative example. (AB).

892 (NEI-DK–957, pp. 1-6) **Biological degradation of petroleum wastes by airlift biological contactor (A.B.C.).** Suksawad, N. (Environmental Engineering Division, Asian Institute of Technology, Bangkok (TH)); Tran, F.T. Dansk Komite for Affald (DAKOFA), Copenhagen (Denmark). 1992. 278p. (CONF-9206295– : 1. International conference and exhibition on biological waste treatment, Herning (Denmark), 1-4 Jun 1992). In *Biowaste'92: Proceedings*. Order Number DE93721513. Source: OSTI; NTIS.

Sponsored by: ISWA and IAWPRC.

A modified version of the Airlift bioreactor that was successfully tested for aerobic digestion of thick biological sludges was specifically modified for the biodegradation of petroleum wastes. The semi-pilot scale unit was continously operated with hydraulic retention time of 24, 10 and 6 hours at 25, 50 and 100 percent of petroleum waste diluted with domestic waste water. Overall performance showed removal efficiency of oil and phenol above 90 percent, that of TCOD above 85 percent and ammonia nitrogen above 97 percent. With proper culture acclimatization, the toxicity of hundred percent petroleum waste did not hinder the removal efficiency, thanks to the fast mixing and the high oxygen transfer rate of this modified airlift biocontactor. (au) (10 refs.).

893 (NEI-NO–278) **Control of the gas system for a rotary kiln reduction plant.** Schei, T.S. Trondheim Univ. (Norway). Norges Tekniske Hoegskole. 1992 256p. Order Number DE93721628. Source: OSTI; NTIS.

In Part 1 of this thesis a set of generic models suitable for the modeling of gas systems found in metallurgical and other industrial processes and power plants are developed and analyzed. This set includes models for fan/duct, structural volume, thermal capacity, quencher and combustion of gaseous reactants. These control system design models give explicit relations between control inputs like the speed of process fans and measurable outputs like pressure and temperature. The models are used for modeling the gas system part of the rotary kiln reduction process for ilmenite ore at Tinfos Titan & Iron, in Tyssedal, Norway. A main reason why control performance is important for this system, is that the gas in the grate-kiln system is not well sealed from the surrounding atmosphere. Hence, it is important that the pressure in this system is kept as close as possible to the atmospheric pressure. Positive differential pressure leads to dust and toxic gases being discharged into the factory premises. On the other hand, negative differential pressure influences the energy balance, expecially in the kiln, where it can lead to local overheating of the ilmenite pellets. Hence, it influences the quality of the final product. This leakage of air into the kiln also influences the energy economy. In Part 2 a procedure for automatic tuning of proportional-integral-derivative (PID) controllers based on transfer function estimation is developed. A main feature of the tuning procedure is a method for the excitation of a closed-loop system in the most important frequency range with respect to control system performance. The closed-loop system is excited by generating limit cycle oscillations in the system at two different frequencies, the crossover frequency and the critical frequency for the feedback loop. 68 refs., 121 figs.

894 (PNL–8164) **Impact evaluation of an energy savings plan project at ARCO Petroleum Products Company.** Spanner, G.E.; Sullivan, G.P.; Dixon, D.R. Pacific Northwest Lab., Richland, WA (United States). Aug 1992. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93000839. Source: OSTI; NTIS; INIS; GPO Dep.

This impact evaluation of an energy conservation measure (ECM) that was recently installed at ARCO Petroleum Products Company (ARCO) was conducted for the Bonneville Power Administration (Bonneville) as part of an evaluation of its Energy $avings Plan (E$P) Program. The Program makes acquisition payments to firms that install energy conservation measures in their industrial procsses. The objective of this impact evaluation was to assess how much electrical energy is being saved at ARCO as a result of the E$P and to determine how much the savings cost Bonneville and the region. The impact of the ECM was evaluated with a combination of engineering analysis, financial analysis, interviews, and submittal reviews (ARCO's Proposal and Completion Report). The ECM itself consists of removing one stage of a six-stage compressor so that its inlet control valve can be opened wider, thereby saving the energy that was previously lost at the valve due to pressure drop. Energy savings resulting from this ECM are expected to be 2,112,800 kwh/yr. The ECM cost $367,650 to install, and ARCO received a payment of $158,460 from Bonneville and $82,902 from its serving utility, Puget Sound Power & Light Company, for the acquisition of energy savings. The ECM would not have been installed without the acquisition payment offered under the E$P Program. The levelized cost of these energy savings to Bonneville will be 6.3 mills/kWh over the ECM's expected 15-year life, and the levelized cost to the region will be 15.8 mills/kWh.

895 (SAND–92-1290C) **Thermal coating development for impulse drying.** Lenling, W.J. (Thermal Spray Technologies, Watertown, WI (United States)); Smith, M.F.; Orloff, D.I. Sandia National Labs., Albuquerque, NM (United States). [1992]. 6p. Sponsored by USDOE, Washington, DC (United States); Institute of Paper Science and Technology, Atlanta, GA (United States). DOE Contract AC04-76DP00789 ;FG02-85CE40738. (CONF-9206135–6: 1992 international thermal spray conference, Orlando, FL (United States), 1-5 Jun 1992). Order Number DE93000710. Source: OSTI; NTIS; GPO Dep.

A plasma sprayed coating has been developed for the heated surface of rolls used in a new energy-efficient paper drying process, known as "Impulse Drying," which could save the US paper industry an estimated $800 million annually in reduced energy costs. Because impulse drying rolls operate at higher surface temperatures than conventional, the thermal properties of the roll surface must be carefully tailored to prevent sheet delamination. A special plasma sprayed thermal barrier coating has been developed to control thermal mass, heat transfer, and steam infiltration. A coated test platen significantly outperformed a comparable uncoated steel platen in preliminary experiments with a heavy-weight

paper grade on a laboratory-scale impulse drying simulator. The coating was then tested on the roll of a pilot-scale impulse dryer. In comparison with conventional wet-pressing, linerboard that was impulse dried showed improved water removal as well as improved physical properties, such as density and specific elastic modulus. The successful prototype coating design has three plasma sprayed layers that are deposited sequentially: (1) a nickel alloy bond coat; (2) a thick 17% porous, zirconia thermal barrier; and (3) a thin, 5–7% porous, zirconia top coat.

896 (YMP-A–33) **Innovations and applications of low- and non-waste technology in the Finnish industry.** Suominen, L. (Insinoeoeritoimisto Mexpert Oy, Espoo (Finland)). Ministry of the Environment, Helsinki (Finland). Environmental Protection Dept. 1985. 242p. (In Finnish). Order Number DE93711136. Source: OSTI; NTIS.

The aim of this subproject has been to publish a handbook of the innovations of Low- and Non-Waste Technology in the Finnish industry. Alltogether nineteen innnovation examples of Low- and Non-Waste Technology in the Finnish industry has been prepared during the summer 1984, where most of the examples are represented by the Finnish pulp and paper and metallurgical industry.

897 **Condensate recovery for steam injection.** den Otter, A.J.; Campbell, P.J.; Nguyen, B.H. 23 Jul 1992. Filed date 22 Jan 1991. Canada Patent patent application 2034749. 13p. Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN.

Water injection has the potential to increase the gross power output of a turbine, or to decrease the amount of fossil fuel consumed for a given useful power output, and to reduce the level of nitrogen oxides emitted by the turbine. It would be desirable to inject water into the turbines which are utilized in the compressor stations of oil or gas transmission networks; however, many such stations are at remote locations where the absence of a suitable water supply has prevented the use of a water injection technique. A process is thus provided to improve the operation of a fossil-fuel-fired turbine by condensing water from the exhaust effluent of the turbine, transferring this water into a condensate storage vessel, and injecting the stored water into the turbine. The process of the invention utilizes a conventional waste heat boiler to use the energy contained in the hot exhaust gas from the turbine to convert water into steam. The gas exiting the waste heat boiler is condensed in a corrosion resistant heat exchanger, and the condensate is stored in a fiber reinforced plastic tank and treated before feeding to the boiler feedwater tank. Control valves are provided for roughly balancing the amount of steam produced by the waste heat boiler with the amount of steam required for injection. 1 fig.

898 **Machine for sorting plastic bottles as a function of their plastic composition in order to recycle the same.** Morin, A.; Hamel, J.C. 21 Jun 1992. Filed date 20 Dec 1990. Canada Patent patent application 2032792. 26p. Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN.

An apparatus and method are disclosed for sorting objects such as bottles made of different transparent or translucent plastic materials according to the kind of plastic material of which these objects are made. The method consists in producing a beam of ultraviolet light and subjecting each object to be sorted to this beam in a detection zone. The intensity of the beam transmitted by the object is detected at different wavelengths selected within a range encompassing the cutoff wavelengths of the different plastic materials to be sorted. The cutoff wavelength is different for each plastic material, and is the wavelength above which the coefficient of light transmission through the plastic material drastically increases. By comparing with each other the values of the intensity detected at the different wavelengths, one can determine the cutoff wavelength of the plastic material and thus identify it. A sorting apparatus would use such an ultraviolet detector in conjunction with a conveying means in order to operate a processing device which would selectively direct the objects conveyed before the detector into different bins corresponding to the kinds of plastic materials being sorted. An apparatus according to the invention has been successfully tested for sorting bottles made of polyvinyl chloride and polyethylene tetraphthalate in real time. 2 figs.

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Refer also to citation(s) 335, 337, 338, 340, 345, 346, 349, 350, 881, 886, 898

899 (DOE/CE/26616–T1) **District cooling engineering and design program: Final report.** District Energy Corp. of Lincoln and Lancaster County, NE (United States). Sep 1992. 101p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG01-91CE26616. Order Number DE93002847. Source: OSTI; NTIS; GPO Dep.

The operation and performance of a system using large commercial heat pumps to heat and cool two public buildings are reported. One of the buildings houses local government offices and the other the jail. The system uses the underground salt water at the site as the energy exchange medium. Included are: the operations summary, system performance, operating procedures, and operating modes. (MHR)

900 (EUR–14254, pp. 5-23) **The role of composting in an integrated waste management system.** Van Belle, W.A. Commission of the European Communities, Luxembourg (Luxembourg). 1992. (CONF-9109436–: Workshop on Composting and Compost Quality Assurance Criteria, Angers (France), 11-13 Sep 1991). In *Composting and compost quality assurance criteria.* 433p. Order Number DE93721257. Source: OSTI; NTIS (US Sales Only).

For household waste, the ideal hierarchy is led by the prevention of waste (10%), followed by reclaiming (50%), next come incineration (25%) and lastly land filling (15%). for the future, only the two last fractions will be allowed to be land filled. The purpose of this paper is to demonstrate the key role composting can and should play in achieving the ambitious 50% reclaiming goal by the year 2000. (A.B.). 2 refs., 18 figs., 3 tabs.

901 (EUR–14254, pp. 24-37) **Objectives for the development of composting in France: a strategic approach.** Noyon, N. (ANRED, 21 - Dijon (FR)). Commission of the European Communities, Luxembourg (Luxembourg). 1992. (CONF-9109436–: Workshop on Composting and Compost Quality Assurance Criteria, Angers (France), 11-13 Sep 1991). In *Composting and compost quality assurance criteria.* 433p. Order Number DE93721257. Source: OSTI; NTIS (US Sales Only).

The strategic approach adopted in France to develop waste composting responds to a concern for reconciling a 'treatment' objective and a 'production' objective, both of which are targeted by managers responsible for the disposal of waste with a high organic content. In terms of environmental concern, this means managing flows of pollutants whose nature is conditioned by the quality of the waste itself as well as by the means of collection and treatment involved. It is necessary to integrate initially in this approach a determination to reduce as much as possible the polluting load of 'heavy metals' and 'non-fermentable matter' contained in consumer goods and ultimately to take into account the actual needs of compost users which may lead to a blend of several compost categories. (A.B.). 6 figs., 1 tab.

902 (EUR–14254, pp. 43-61) **Survey on biowaste activities in Denmark and the nordic countries.** Jespersen, L.M. Commission of the European Communities, Luxembourg (Luxembourg). 1992. (CONF-9109436–: Workshop on Composting and Compost Quality Assurance Criteria, Angers (France), 11-13 Sep 1991). In *Composting and compost quality assurance criteria.* 433p. Order Number DE93721257. Source: OSTI; NTIS (US Sales Only).

A survey on biowaste activities in the Nordic countries has been carried out primarily concentrating on systems suited for collection and treatment of household biowaste from societies with more than 2000 inhabitants. Of the Nordic countries only Denmark and Sweden have introduced such systems until now. The legislative aspects concerning recycling of biowaste have been examined, and 7 ongoing biowaste collection systems and 5 central biowaste

recycling plants in Denmark and 7 ongoing biowaste collection systems and 2 central biowaste recycling treatment plants in Sweden have been evaluated as regards the collection system, the treatment system, environmental and sanitary aspects, working environment, product quality and recycling efficiency. (author). 4 refs., 1 fig., 10 tabs.

903 (EUR–14254, pp. 62-68) **The Danish programme on joint biogas plants.** Sandholt, K. (Atomenergikommissionen, Copenhagen (Denmark)). Commission of the European Communities, Luxembourg (Luxembourg). 1992. (CONF-9109436–: Workshop on Composting and Compost Quality Assurance Criteria, Angers (France), 11-13 Sep 1991). In *Composting and compost quality assurance criteria.* 433p. Order Number DE93721257. Source: OSTI; NTIS (US Sales Only).

The Action Programme for Joint Biogas Plants in Denmark was drawn up by the ministries of Agriculture, Energy and the Environment with the purpose to clarify whether, through a technological development of full-scale joint biogas plants, commercially competitive plants could be developed. Anaerobic digestion has several advantages compared to composting. Most importantly biogas is a renewable energy source, from which electricity can be generated. Also, composting results in a 50% loss of nitrogen due to ammonia volatilization. All nutrients are preserved throughout the digestion process. Furthermore, in a joint biogas plant, the nutrients are automatically recycled to the farmland, due to the associated transport infrastructure. Pre-sorted MSW = Municipal Solid Wastes is not used in joint biogas plants, and poses no biological problems. (author). 3 figs.

904 (EUR–14254, pp. 69-80) **The composting process applied to sewage sludge and source separated refuse.** Stentiford, E.I. (Leeds Univ. (United Kingdom)). Commission of the European Communities, Luxembourg (Luxembourg). 1992. (CONF-9109436–: Workshop on Composting and Compost Quality Assurance Criteria, Angers (France), 11-13 Sep 1991). In *Composting and compost quality assurance criteria.* 433p. Order Number DE93721257. Source: OSTI; NTIS (US Sales Only).

Source separation both for municipal solid waste (MSW) and sewage sludge offers one of the most cost effective routes for improving the quality of the raw material. Both of these wastes are amenable to composting using a wide range of process systems. Provided the necessary conditions of aeration, temperature and moisture are maintained then systems from low cost windrows to high cost reactor systems can all produce acceptable composts. (author). 10 refs., 4 figs., 3 tabs.

905 (EUR–14254, pp. 85-93) **The control of the composting process and quality of end products.** Bertoldi, M. de (Udine Univ. (IT)). Commission of the European Communities, Luxembourg (Luxembourg). 1992. (CONF-9109436–: Workshop on Composting and Compost Quality Assurance Criteria, Angers (France), 11-13 Sep 1991). In *Composting and compost quality assurance criteria.* 433p. Order Number DE93721257. Source: OSTI; NTIS (US Sales Only).

After a definition of composting, this paper presents relations between the starting materials composition, the composting parameters (temperature, aeration, moisture, carbon/nitrogen ratio, ph level), the composting process control and the end product quality. (A.B.). 21 refs.

906 (EUR–14254, pp. 94-97) **Parameters for sorting/composting of municipal solid wastes.** Morvan, B. (Centre National Machinisme Agricole, Genie Rural, Eaux et Forets (CEMAGREF), 35 - Rennes (FR)). Commission of the European Communities, Luxembourg (Luxembourg). 1992. (CONF-9109436–: Workshop on Composting and Compost Quality Assurance Criteria, Angers (France), 11-13 Sep 1991). In *Composting and compost quality assurance criteria.* 433p. Order Number DE93721257. Source: OSTI; NTIS (US Sales Only).

The organic matter required for the production of urban compost may be provided by several categories of waste i.e. raw urban waste or refuse presorted at source, green waste, and kitchen waste. In order to ensure the sale of this urban compost, positive quality criteria such as levels of organic matter, CaO, MgO, N, P_2O_5 and K_2O can be defined. It is also possible to determine thresholds for unwanted particles such as glass, plastics, and metals since these impurities are a major factor in the low selling price of urban compost. (author). 2 tabs.

907 (EUR–14254, pp. 98-102) **Anaerobic digestion of source-sorted MSW.** Breinholt, T. (Atomenergikommissionen, Copenhagen (Denmark)). Commission of the European Communities, Luxembourg (Luxembourg). 1992. (CONF-9109436–: Workshop on Composting and Compost Quality Assurance Criteria, Angers (France), 11-13 Sep 1991). In *Composting and compost quality assurance criteria.* 433p. Order Number DE93721257. Source: OSTI; NTIS (US Sales Only).

In Denmark, various means of disposing of municipal solid waste (MSW) have been tried out. As one of the novel methods, anaerobic digestion seem to offer many advantages compared to more traditional ways of handling MSW. A 3-year Action Plan involving 9 full-scale centralized biogas plants has just been concluded, and the results have shown, that mixing animal waste with other types of waste such as MSW, sewage sludge and industrial organic waste is economically, environmentally and agriculturally very advantageous. Such plants could be the waste treatment plants of the future. (author). 1 fig., 1 tab.

908 (EUR–14254, pp. 103-109) **Dry anaerobic conversion of municipal solid waste by means of the Dranco process.** Six, W. (Organic Waste Systems N.V., Gent (BE)); Baere, L. de. Commission of the European Communities, Luxembourg (Luxembourg). 1992. (CONF-9109436–: Workshop on Composting and Compost Quality Assurance Criteria, Angers (France), 11-13 Sep 1991). In *Composting and compost quality assurance criteria.* 433p. Order Number DE93721257. Source: OSTI; NTIS (US Sales Only).

The Dranco process has been developed for the conversion of solid organic wastes, specifically the organic fraction of municipal solid waste (MSW), to energy and an humus-like final product. The Dranco process can be compared to landfill gas production, accelerated by a factor 1000. A Dranco installation with a digester of 808 m^3 treating 10.500 tons of source separated waste per year will be constructed in 1991 at Brecht, Belgium. A description of the plant is elaborated. A demonstration plant of 56 m^3 is in operation since several years in Gent, Belgium using mixed garbage as feedstock. The gas production process is finalized in 3 weeks. The final product is dewatered and further stabilized in a 10 day during aerobic posttreatment. (A.B.). 2 refs., 2 figs., 3 tabs.

909 (EUR–14254, pp. 110-116) **Odour emissions from composting plants.** Bidlingmaier, W. (Stuttgart Univ. (Germany)). Commission of the European Communities, Luxembourg (Luxembourg). 1992. (CONF-9109436–: Workshop on Composting and Compost Quality Assurance Criteria, Angers (France), 11-13 Sep 1991). In *Composting and compost quality assurance criteria.* 433p. Order Number DE93721257. Source: OSTI; NTIS (US Sales Only).

The principal sources of odors in a composting plant are: the receiving area, the pretreatments, the storage area, the rotting area, the final treatment. Various solutions for these sources are presented with results. (A.B.). 1 ref., 8 tabs.

910 (EUR–14254, pp. 117-130) **Microbial emissions from composts made for mushroom production and from domestic waste.** Lacey, J. (Rothamsted Experimental Station, Harpenden (United Kingdom)); Williamson, P.A.M.; Crook, B. Commission of the European Communities, Luxembourg (Luxembourg). 1992. (CONF-9109436–: Workshop on Composting and Compost Quality Assurance Criteria, Angers (France), 11-13 Sep 1991). In *Composting and compost quality assurance criteria.* 433p. Order Number DE93721257. Source: OSTI; NTIS (US Sales Only).

The handling of freshly made compost, whether made for mushroom production or from domestic waste can result in the emission of large numbers of microorganisms. Actinomycete and fungal spores exceeded concentrations associated with allergic alveolitis and Aspergillus fumigatus was sometimes abundant, especially in domestic waste composts, presenting a risk of asthma, alveolitis and infection. Numbers of Gram-negative bacteria were consistently greater than levels recommended to avoid endotoxin effects. The hazard from airborne spores is less in growing houses and the

risk is mostly from immediate asthmatic reactions to moulds growing on the compost or wooden boxes. (author). 20 refs.

911 (EUR–14254, pp. 131-140) **Composting control parameters and compost product characteristics.** Lopez-Real, J. (London Univ. (United Kingdom)); Vere, A. Commission of the European Communities, Luxembourg (Luxembourg). 1992. (CONF-9109436–: Workshop on Composting and Compost Quality Assurance Criteria, Angers (France), 11-13 Sep 1991). In *Composting and compost quality assurance criteria.* 433p. Order Number DE93721257. Source: OSTI; NTIS (US Sales Only).

The composting process is a highly flexible biodegradative mechanism which can be engineered to meet objectives of either weight, volume or moisture reduction of organic wastes and potentially the production of a marketable end product. Control parameters reflecting these choices are discussed together with the characteristic of the end products that result. Flexibility towards standards and specifications are urged with respect to both processing and to end product in order to allow composting to achieve its full potential for helping to solve societal waste problems and conservation of natural wetland habitats. (author). 13 refs., 1 fig., 1 tab.

912 (EUR–14254, pp. 145-148) **Marketing of standardized composts.** Barth, J. (German Compost Quality Assurance Organization, Oelde (DE)). Commission of the European Communities, Luxembourg (Luxembourg). 1992. (CONF-9109436–: Workshop on Composting and Compost Quality Assurance Criteria, Angers (France), 11-13 Sep 1991). In *Composting and compost quality assurance criteria.* 433p. Order Number DE93721257. Source: OSTI; NTIS (US Sales Only).

Compost needs a standardized quality product in order to be sold on a large scale. If it is produced according to the criteria and directions of the RAL compost quality sign of the German Compost Quality Assurance Organization it fulfills these requirements. Compost needs a marketing strategy like any other product. Developing compost marketing models requires knowledge of special characteristics of the compost market. These characteristics and the comparison with competitive industries show that the model for a common marketing organization of the compost producers will have the best chance to guarantee market success. This marketing organization has to be established now before the large compost quantities reach the market, which is to be reckoned with in the near future. (author). 3 refs.

913 (EUR–14254, pp. 149-164) **Assessment study on organic fertilizers.** Hedegaard, M. Commission of the European Communities, Luxembourg (Luxembourg). 1992. (CONF-9109436–: Workshop on Composting and Compost Quality Assurance Criteria, Angers (France), 11-13 Sep 1991). In *Composting and compost quality assurance criteria.* 433p. Order Number DE93721257. Source: OSTI; NTIS (US Sales Only).

Results of compost chemical analyses with different parameters (pH, temperature, metal concentration, chemical dosage time, range of chemical input) for dry matter, nitrogen, phosphorous, potassium and COD, a mass balance of the outlined process and parameters of economy as regards input chemicals and capital costs, and a product evaluation of the upgraded organic fertilizer are presented in a synthetic way. (A.B.). 6 figs.

914 (EUR–14254, pp. 165-172) **Composts market studies and supply demand analysis.** Merillot, J.M. (ANRED, 49 - Angers (FR)). Commission of the European Communities, Luxembourg (Luxembourg). 1992. (CONF-9109436–: Workshop on Composting and Compost Quality Assurance Criteria, Angers (France), 11-13 Sep 1991). In *Composting and compost quality assurance criteria.* 433p. Order Number DE93721257. Source: OSTI; NTIS (US Sales Only).

Generally, composting involves organic matter recycling. To avoid the production of 'unused' composts and then to assure a sustainable recycling, marketing tools are necessary and very helpful. After having determined the specific production constraints of composting projects, the behaviour of potential users is analysed through marketing inquiries and conclusions are drawn for the conception and management policy of composting plants and on the role and strategies of public and private organizations for the development of an environmentally safe demand and use of waste-derived-composts. (author). 4 refs., 3 figs.

915 (EUR–14254, pp. 173-183) **Reference methods for analysis of composts.** Gaebriels, R. (Ornamental Crops Research Institute, Melle (BE)); Verdonck, O. Commission of the European Communities, Luxembourg (Luxembourg). 1992. (CONF-9109436–: Workshop on Composting and Compost Quality Assurance Criteria, Angers (France), 11-13 Sep 1991). In *Composting and compost quality assurance criteria.* 433p. Order Number DE93721257. Source: OSTI; NTIS (US Sales Only).

By establishing a reference method, used by all laboratories to analyze compost (end product), we will have a way not only for expressing the results on a common basis but also for evaluating the quality criteria when used as organic amendment or as a growing medium. This paper describes a proposed reference method with recommendations regarding the handling of the equipment, sample preparation and methods for physical and chemical characterization. (author). 5 figs.

916 (EUR–14254, pp. 184-187) **New standards and compost quality in the Federal Republic of Germany: the standards, the organisation for control, acceptance in practice.** Kehres, B. (Bundesverband der Deutschen Entsorgungswirtschaft (BDE), Koeln (DE)). Commission of the European Communities, Luxembourg (Luxembourg). 1992. (CONF-9109436–: Workshop on Composting and Compost Quality Assurance Criteria, Angers (France), 11-13 Sep 1991). In *Composting and compost quality assurance criteria.* 433p. Order Number DE93721257. Source: OSTI; NTIS (US Sales Only).

The separate collection and composting of biological waste from households, industry and local authorities is now state of the art in the Federal Republic of Germany. In setting up the German Quality Association for Composts (Bundesguetegemeinschaft Kompost e.V.), compost producers have joined together with the objective of assuring the quality of their products. High quality composts can be labelled with a registered quality symbol. The quality required of composts using this symbol, and the system of quality assurance are described. (author). 7 refs.

917 (EUR–14254, pp. 188-196) **Use of mineralization kinetics to estimate the agricultural value of organic fertilizers.** Cheneby, D. (Institut National de Recherches Agronomiques (INRA), 21 - Dijon (France)); Nicolardot, B. Commission of the European Communities, Luxembourg (Luxembourg). 1992. (CONF-9109436–: Workshop on Composting and Compost Quality Assurance Criteria, Angers (France), 11-13 Sep 1991). In *Composting and compost quality assurance criteria.* 433p. Order Number DE93721257. Source: OSTI; NTIS (US Sales Only).

The agricultural values of organic fertilizers can be estimated with laboratory mineralization kinetics. In contrast to physical and chemical determinations, laboratory incubations of organic fertilizers provide information on organic matter decomposition and on the availability of the most important elements such as nitrogen for example. These laboratory incubation techniques are also less time-consuming and less expensive than field experiments. Our experimental investigations concerned particle-size fractions of poplar bark composted with poultry droppings and on the other hand, mixtures of refuse compost and poultry droppings. (author). 11 refs., 2 figs., 4 tabs.

918 (EUR–14254, pp. 197-203) **In-vessel composting system and test of compost products for professional greenhouse growers.** Jespersen, L.M. Commission of the European Communities, Luxembourg (Luxembourg). 1992. (CONF-9109436–: Workshop on Composting and Compost Quality Assurance Criteria, Angers (France), 11-13 Sep 1991). In *Composting and compost quality assurance criteria.* 433p. Order Number DE93721257. Source: OSTI; NTIS (US Sales Only).

In the VJ-Center plant different solid and liquid organic waste products are treated hereby producing energy in the form of biogas from an anaerobic fixed film reactor and heat from an in-vessel heat composting plant. The heat is used in the plant for production of eel in a 100 t per year plant, and the organic waste products are converted into marketable products, among other horticultural substrates based on compost and peat, which are to be tested in

different greenhouse cultures in a greenhouse at the plant. (author). 2 refs., 1 fig., 3 tabs.

919 (EUR–14254, pp. 204-226) **Results of experimental work on composts and their quality in relation to plant growth and environmental standards.** Smith, S.R. (Water Research Association, Medmenham (United Kingdom)); Hall, J.E. Commission of the European Communities, Luxembourg (Luxembourg). 1992. (CONF-9109436–: Workshop on Composting and Compost Quality Assurance Criteria, Angers (France), 11-13 Sep 1991). In *Composting and compost quality assurance criteria.* 433p. Order Number DE93721257. Source: OSTI; NTIS (US Sales Only).

Two waste derived composts based on sewage sludge, liquid and dewatered sludges composted with straw, and one waste derived compost based on screened municipal solid wastes were compared with peat in a pot trial where the materials were mixed at five different levels with a sandy soil, with and without fertilizer, in which Petunia grandiflora were grown. Flower number was used as a measure of compost quality and was compared with shoot dry weight, nutrient, pH and conductivity of the growing media. Heavy metals concentrations were also controlled in plants. Results showed that all composts tested have potential value as growing media and that all were superior to peat. (A.B.). 32 refs., 11 figs., 2 tabs.

920 (EUR–14254, pp. 227-236) **Organic chemicals in compost: how relevant are they for the use of it.** Vogtmann, H. (Kassel Univ. (Gesamthochschule) (Germany)); Fricke, K. Commission of the European Communities, Luxembourg (Luxembourg). 1992. (CONF-9109436–: Workshop on Composting and Compost Quality Assurance Criteria, Angers (France), 11-13 Sep 1991). In *Composting and compost quality assurance criteria.* 433p. Order Number DE93721257. Source: OSTI; NTIS (US Sales Only).

The successful separate collection of biogenic wastes from households and municipalities has given rise to increased activities in composting. It is, however, of great importance to produce compost of highest quality to guarantee a wide range of applications of compost in plant production. An extensive survey was conducted to gain information about the status quo of biogenic waste composting in Germany. Data were obtained and statistically treated in various fields, such as construction of composting plants, composting techniques, with emphasis on organic chemicals as an important factor for compost quality. The results showed concentrations of CBP, PAK, PCDD and PCDF in compost lower than in forest soils, which should not restrict the use of biogenic waste compost in plant production. (author). 28 refs., 2 figs., 3 tabs.

921 (EUR–14254, pp. 237-248) **Transfer of inorganic pollution by composts.** Linieres, M. (Institut National de Recherches Agronomiques (INRA), 33 - Talence (France)). Commission of the European Communities, Luxembourg (Luxembourg). 1992. (CONF-9109436–: Workshop on Composting and Compost Quality Assurance Criteria, Angers (France), 11-13 Sep 1991). In *Composting and compost quality assurance criteria.* 433p. Order Number DE93721257. Source: OSTI; NTIS (US Sales Only).

The inorganic pollution of agricultural soils is to be expected from various kinds of organic fertilizers, especially from municipal solid wastes, by increasing the load of potentially toxic elements in the medium. Occurrence of mobile trace elements in household refuses is a major cause of the food chain contamination. Zinc, Copper, Boron, Lead and Mercury have been demonstrated to be the most bioavailable elements from conventional MSW. A great part of them can be eliminated by separate collection and sorting-composting techniques. However it remains that the trace element bioavailability has to be assessed in the only fermentable part of wastes. Finally, salinity excess and leachable nitrates are other pollution sources to be kept in mind, especially in the case of intensive and cumulative supplies of MSW. (author). 12 refs.; 1 fig., 7 tabs.

922 (EUR–14254, pp. 251-293) **United Kingdom waste management survey 1990-1991.** Searle, G. Commission of the European Communities, Luxembourg (Luxembourg). 1992. (CONF-9109436–: Workshop on Composting and Compost Quality Assurance Criteria, Angers (France), 11-13 Sep 1991). In *Composting and compost quality assurance criteria.* 433p. Order Number DE93721257. Source: OSTI; NTIS (US Sales Only).

A survey was conducted of all local authorities in the UK. Abstracts were prepared of those sections of each Waste Disposal Authority's Waste Management Plan lodged with the Department of the Environment which dealt with the reclamation of organic materials. By June 1991, 34 WMPs had been inspected and are reported here. The remainder will be reviewed as they are received. (author).

923 (EUR–14254, pp. 294-330) **Compost standards without tears - some ideas from the UK.** Bardos, R.P. (Warren Spring Lab., Stevenage (United Kingdom)); Hadley, P.; Kendle, A. Commission of the European Communities, Luxembourg (Luxembourg). 1992. (CONF-9109436–: Workshop on Composting and Compost Quality Assurance Criteria, Angers (France), 11-13 Sep 1991). In *Composting and compost quality assurance criteria.* 433p. Order Number DE93721257. Source: OSTI; NTIS (US Sales Only).

The objective of this paper is to describe a rationale for compost standard development in the UK, which encompasses a range of points of view from producers, vendors, users and researchers. To achieve this a large group of professionals with an interest in composting has been consulted. This paper represents the majority consensus of opinions within the group; significant dissenting points of view are also included. The scope of the paper is the development of an approach to compost standards acceptable to as broad a range of producers, researchers and users as possible. (author). 35 refs., 3 tabs.

924 (EUR–14254, pp. 331-351) **A review of European compost standards.** Mullett, J.A.J. (Advanced Recycling Technologies Ltd., Cambridge (GB)). Commission of the European Communities, Luxembourg (Luxembourg). 1992. (CONF-9109436–: Workshop on Composting and Compost Quality Assurance Criteria, Angers (France), 11-13 Sep 1991). In *Composting and compost quality assurance criteria.* 433p. Order Number DE93721257. Source: OSTI; NTIS (US Sales Only).

Composting of organic waste materials is being adopted in Europe as a significant waste-treatment option. Certain countries have 'standards' by which to define acceptable composts. These standards vary both in their objective and in their scope. This paper reviews some of the existing standards, considers the activities of the national and international standard-setting organisations, describes the different types of standards available, and examines the differing requirements that need to be met by 'compost standards'. (authors). 11 refs., 6 tabs.

925 (EUR–14254, pp. 352-367) **Composting in Denmark.** Commission of the European Communities, Luxembourg (Luxembourg). 1992. (CONF-9109436–: Workshop on Composting and Compost Quality Assurance Criteria, Angers (France), 11-13 Sep 1991). In *Composting and compost quality assurance criteria.* 433p. Order Number DE93721257. Source: OSTI; NTIS (US Sales Only).

This paper presents order and law concerning trade in fertilizers, soil conditioners, growth media, penalties... (A.B.).

926 (EUR–14254, pp. 377-384) **Composting in Greece.** Balis, C. (Agricultural University of Athens (GR)). Commission of the European Communities, Luxembourg (Luxembourg). 1992. (CONF-9109436–: Workshop on Composting and Compost Quality Assurance Criteria, Angers (France), 11-13 Sep 1991). In *Composting and compost quality assurance criteria.* 433p. Order Number DE93721257. Source: OSTI; NTIS (US Sales Only).

A list of the principal composting industries and a table of the present research activities on recycling and composting of solid organic wastes are presented in this paper. (A.B.).

927 (EUR–14254, pp. 385-401) **Composting in Germany.** Commission of the European Communities, Luxembourg (Luxembourg). 1992. (CONF-9109436–: Workshop on Composting and Compost Quality Assurance Criteria, Angers (France), 11-13 Sep 1991). In *Composting and compost quality assurance criteria.* 433p. Order Number DE93721257. Source: OSTI; NTIS (US Sales Only).

This text provides an overview of the means of and conditions for composting. It is intended to help in promoting the incorporation

of these treatment methods in waste disposal concepts as an integral part of waste management. In addition, it should provide useful information for those municipalities which are obliged to introduce composting under Land legislation governing waste disposal. (author). 6 figs.

928 (EUR–14254, pp. 402-406) **Composting: status of research and commercial production in Ireland.** Prasad, M. (Peat Research Centre, Newbridge (IE)). Commission of the European Communities, Luxembourg (Luxembourg). 1992. (CONF-9109436–: Workshop on Composting and Compost Quality Assurance Criteria, Angers (France), 11-13 Sep 1991). In *Composting and compost quality assurance criteria.* 433p. Order Number DE93721257. Source: OSTI; NTIS (US Sales Only).

Very little research has been carried out on composting in Ireland. Preliminary work has been carried out by the Peat Research centre on composting of fish and brewery waste and silage effluent with peat as bulking agent and using static and turned piles. The results from this work indicates that the composted product can be used as a soil amendment/fertilizer. Composting of spent mushroom compost (SMC) has been carried successfully by Kinsealy Research Centre using turned piles. The composted product was also suitable as a soil amendment/fertilizer. However, as an organic growing substrate it would need to be blended with peat to reduce EC. Composting on a commercial scale is being carried out mainly by three films in Ireland. The major waste used is dried cattle manure, SMC, chicken manure and straw. The quantities produced is relatively small and the products are sold mostly for soil amendment. Quality control is minimal and standards for compost quality has still to be determined in Ireland. (author). 5 ref., 2 tabs.

929 (Juel–2593) **Development of a pulsation drier for sewage sludge.** Glorius, T. Forschungszentrum Juelich GmbH (Germany). Inst. fuer Chemische Technologie; Technische Hochschule Aachen (Germany). Mar 1992. 125p. (In German). Order Number DE93720186. Source: OSTI; NTIS (US Sales Only).

The possibility of using hot pulsating flows for direct drying of sewage sludge was investigated in a pilot plant. A pulsation diver was developed which has a pulsed burner for flue gas generation with an evaporation capacity of 200-400 kg H_2 O/h, it is suited for small-scale to medium-scale sewage plants. Mechanically dewatered sewage sludge containing 25-35% of dry matter is concentrated to 70-90% dry matter in less than 10 minutes. The dry matter has a temperature of 80-100deg C and a mean particle diameter of 3-4 mm. The raw gas concentrations of dust, carbon and heavy metals in the drier emissions are near, or just above, the limiting values. They must be lowered by means of primary (air flow control) or secondary measures (exhaust purification); the noise level of about 90 db (A) must be lowered. (orig.).

930 (NEDO-ITE–9104) **Survey of an evaluation method for CO_2 reduction technology in the fossil fuel much-consuming industry field.** New Energy and Industrial Technology Development Organization, Tokyo (Japan). Mar 1992. 233p. (In Japanese). Sponsored by New Energy and Industrial Technology Development Organization, Tokyo (Japan). Order Number DE93723971. Source: OSTI; NTIS.

The method similar to inter-industry relations analysis is proposed to establish the method for making a quantitative evaluation of the effects of various technologies for CO_2 emission reduction measures in the fossil fuel much-consuming industry field. In the production process, a new concept, a cumulative CO_2 emission unit requirement (ϕ) is made an evaluation index. In each unit which composes the process, an in/out relationship of materials is expressed linearly, and it is supposed that the connection state between units is already known, and ϕ for raw materials and energy to be used and necessary expenses including equipment and personnel are given as initial conditions. Then, ϕ per product unit quantity can be calculated by the method similar to the inter-industry relations analysis. As basic data, the present situation of CO_2 emission and flow of materials/energy in the following four fossil fuel much-consuming industries are studied: electric power, cement, iron making and nonferrous metal smelting. As a result of trially applying the method of typical plants in the above-mentioned four industries in terms of the present technology and improved technology, validity of this evaluation method is confirmed and ϕ of each product can be calculated. 39 refs. 83 figs., 96 tabs.

931 (NEI-DK–957) **Biowaste'92: Proceedings.** Dansk Komite for Affald (DAKOFA), Copenhagen (Denmark). 1992 278p. (CONF-9206295–: 1. International conference and exhibition on biological waste treatment, Herning (Denmark), 1-4 Jun 1992). Order Number DE93721513. Source: OSTI; NTIS.

Sponsored by: ISWA and IAWPRC.

The papers presented at a conference on biowaste held in Herning, Denmark, on June 1-4, 1992, concern the management of municipal and other organic wastes by biodegradation. Various aspects of this subject are dealt with. Current national environmental policies tend to favour waste handling processes, such as biodegradation, which contribute to pollution abatement. The fuel methane is a product of biomass conversion, and this is another advantage of waste management by aerobic or anaerobic processes. (AB).

932 (NEI-DK–957, pp. 1-10) **Advanced aerobic composting of biowaste from refuse in the context of Dutch solid waste management.** Oorthuys, T. (Grontmij Consulting Engineers, De Bilt (NL)); Koning, R. Dansk Komite for Affald (DAKOFA), Copenhagen (Denmark). 1992. 278p. (CONF-9206295–: 1. International conference and exhibition on biological waste treatment, Herning (Denmark), 1-4 Jun 1992). In *Biowaste'92: Proceedings.* Order Number DE93721513. Source: OSTI; NTIS.

Sponsored by: ISWA and IAWPRC.

A large scale aerobic pile composting system, operated in a fully enclosed building, of which the first of its kind has been build in the city of Medemblik, is available for further implementation on a regional scale. The system is based on a thoroughly established technology. Moreover, a standard design has been developed, in which varations are possible according to the local situation. With this, not only can the policy driven rapid implementation of regional composting plants be realized, but also a type of composting plant can be brought into operation which is characterized by a large degree of reliability and flexibility in respect of the future capacity and compost quality. (au).

933 (NEI-DK–957, pp. 1-10) **Implications of site design and operational factors on optimisation of landfills as bioreactors.** Campbell, D.J.V. (Environmental Safety Centre, AEA Environment and Energy, Harwell, Didcot, Oxfordshire (GB)). Dansk Komite for Affald (DAKOFA), Copenhagen (Denmark). 1992. 278p. (CONF-9206295–: 1. International conference and exhibition on biological waste treatment, Herning (Denmark), 1-4 Jun 1992). In *Biowaste'92: Proceedings.* Order Number DE93721513. Source: OSTI; NTIS.

Sponsored by: ISWA and IAWPRC.

A landfill site has traditonally been seen as the final repository for receiving a wide variety of untreated or pretreated wastes, until recently, however, little attention has been paid to the numerous parameters that control the fate of those wastes following deposition, and which impact on biochemical degradation processes. In turn, little control has been evident to alleviate potential pollution threats caused by the liquid and gaseous end products of such processes. Improvements to landfilling standards have been brought about in recent years by the introduction of stricter legislation, and, improved enforcement standards. However, such changes are increasingly resulting in sites where indefinite waste storage is becoming the norm, rather than the ultimate and safe reassimilation of waste contaminants back into the environment. An alternative approach is to develop sites as bioreactors, whereby wastes of various compatible types, are allowed to degrade rapidly. This can only be achieved by the development of appropriate site design and operating procedures. The paper will focus on the need to permit various types of waste to be co-deposited, recognising the importance of this for ensuring the optimum conditions for moisture, temperature and pH control. The approach also provides for eventual controlled release of contaminants. It is acknowledged that some of the required operational practices are completely contrary to current guidance. For example, high moisture content is a neccessity for bioreactor optimisation, whereas current operational guidance requires minimisation of moisture ingress. (AB).

934 (NEI-DK–957, pp. 1-7) **Perspectives og biological waste handling in Germany.** Bergs, C.G. (Ministry of Environment (DE)). Dansk Komite for Affald (DAKOFA), Copenhagen (Denmark). 1992. 278p. (CONF-9206295–: 1. International conference and exhibition on biological waste treatment, Herning (Denmark), 1-4 Jun 1992). In *Biowaste'92: Proceedings.* Order Number DE93721513. Source: OSTI; NTIS.

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Composting will become a central element in waste management policy in Germany. In order to produce compost of high quality, it is necessary to collect bio - waste separately. (au).

935 (NEI-DK–957, pp. 1-11) **Biological waste treatment in global perspective.** Harper, S.R. (Engineering-Science, Inc., Atlanta, GA (US)); Pohland, F.G.; Roeder, M.L. Dansk Komite for Affald (DAKOFA), Copenhagen (Denmark). 1992. 278p. (CONF-9206295–: 1. International conference and exhibition on biological waste treatment, Herning (Denmark), 1-4 Jun 1992). In *Biowaste'92: Proceedings.* Order Number DE93721513. Source: OSTI; NTIS.

Sponsored by: ISWA and IAWPRC.

Opportunities for application of biological waste treatment systems to a variety of municipal, agricultural, and industrial wastes are reviewed within a global perspective. A survey of papers published or reviewed in selected journals between 1988 and 1991 was used as a primary resource to contrast aerobic and anaerobic wastewater treatment systems. Recent efforts associated with biodegradation of solid wastes in controlled systems, including landfills, are also summarized. (au) (32 refs.).

936 (NEI-DK–958) **General predictive control of energy systems.** Eksamensprojekt - IMSOR, 6/92. Bjerre, T. Technical Univ. of Denmark, Lyngby (Denmark). Inst. of Mathematical and Operations Research. 1992 188p. (In Danish). Order Number DE93721409. Source: OSTI; NTIS.

A GPC (General predictive control regulator) controller based on a timevarying ARMAX model is developed and implemented for simulation studies. Using a standard single-step-ahead parameter estimator gives no guarantee for good long range predictions. A multistep prediction error estimator is introduced as a dual of the control law. Estimation of periodic timevarying parameters in ARMAX models is discussed. The control weighing parameter in GPC is given a rubustification interpretation. For systems with unknown future setpoint, the GPC control law needs forecasting of the setpoint. Thus methods for forecasting the ambience temperature is considered. (au) (25 refs.).

937 (NEI-DK–960) **Dynamic modelling of individual components in substations.** Energiministeriets Energiforskningsprogram. Fjernvarme og produktion af el og varme. Poulsen, H. Danmarks Tekniske Hoejskole, Lyngby (Denmark). Lab. for Varme- og Klimateknik. Apr 1992 80p. (In Danish). Contract ENS-1323/89-12. Order Number DE93721468. Source: OSTI; NTIS.

EFP-89.

Dynamic and static models of typical components of substations in connection with larger district heating systems are introduced. Components dealt with are heat exchangers, plate heat exchangers, tube and shell heat exchangers, tubes, accumulator tanks, temperature sensors, valves and controllers (P, PI, PD and PID). These are analysed and described mathematically in order to facilitate modelling by different tools for dynamic simulation. The programme package DYSIM is used. There is a small but constant deviation (less than 5%) between measured and simulated temperatures. The models are evaluated. (AB) (15 refs.).

938 (NEI-DK–961) **Improvement of existing district heating substations.** Energiministeriets Energiforskningsprogram. Fjernvarme og produktion af el og varme. Poulsen, H. Danmarks Tekniske Hoejskole, Lyngby (Denmark). Lab. for Varme- og Klimateknik. Apr 1992 90p. (In Danish). Contract ENS-1323/89-12. Order Number DE93721427. Source: OSTI; NTIS.

EFP-89.

Danish district heating systems typically supply multistory buildings connected to the system by a substation. Some substations were studied thermodynamically and on-line measurements of temperature and flow were carried out. Substations are often equipped with a pressure difference compensator to ensure constant pressure to a central heating system. The compensator should be placed so that it can regulate the total system. It can be connected to the district heating system by a heat exchanger system to produce a constant pressure on the regulation valves, which gives a steady regulation of the hot water system. A cascade regulation of the tap water temperature is also recommended. Accumulator tanks with inlet at the bottom and outlet at the top, (in association with heat exchangers) should be dimensioned according to the time of the electrolysis treatment. Cold water should be preheated so that the cooling of the district heating water is optimized. Suggestions as to positioning of pump and inlets to tanks are illustrated by diagrams. Tap water systems with heat transfer inside the accumulator tank should be placed vertically. Optimization of cooling can be achieved by the use of two accumulator tanks with cold water preheated in the first and then entering at the bottom of the second tank, and where circulation enters this second tank between the top and the heating spiral. Dimensions of the regulating valve should be small in hot water systems consisting of only one heat exchanger without an accumulator tank. (AB).

939 **Recycling system.** Vandervalk, J.H. 12 Jun 1992. Filed date 20 Mar 1992. Canada Patent patent application 2063613. 22p. Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN.

An apparatus and method are provided for processing materials to be recycled. The materials are sorted and retained in individual bins. The apparatus includes a receiving station for receiving the individual bins; a material transporting device having a pair of opposed ends; and a dumping station in cooperative association with the receiving station and one end of the material transporting device. The dumping station is adapted to receive the individual bins of material and dump the material from the individual bins onto the material transporting device. A plurality of separate storage containers are provided and positioned at the other end of the material transporting device. The material transporting device is movable to be placed in cooperative engagement with a selected one of the plurality of storage containers. 2 figs.

3209 Education and Public Relations

Refer also to citation(s) 873, 874, 887

33 ADVANCED PROPULSION SYSTEMS

3301 Internal Combustion Engines

Refer also to citation(s) 945

940 (DOE/AL/33209–T1) **Investigation of essential elements of stratified-charge combustion: Final technical report, October 1, 1985–December 31, 1989.** Bracco, F.V. Princeton Univ., NJ (United States). Dept. of Mechanical and Aerospace Engineering. [1989]. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AS04-86AL33209. Order Number DE93000644. Source: OSTI; NTIS; GPO Dep.

Laser Doppler velocimetry has been used to make cycle-resolved velocity and turbulence measurements in a homogeneous-charge, spark-ignition engine. The engine had a ported intake and disc-shaped chamber with a compression ratio of 8 to 1. It was operated at a speed of 1200 rpm and with a TDC swirl number of 4. A stoichiometric propane-air mixture was used, and ignition was near the wall. The velocity measurements were made at three spatial locations at the midpoint of the clearance height. Tests were made to determine whether the presence of the flame affected the accuracy of the velocity measurements. It was found that the ensemble-averaged mean velocity shows a small deviation, and the rms fluctuation intensity is significantly influenced, but the effects appear to be confined to the flame zone. Data rates were sufficiently high in the preflame and postflame regions to determine the velocity history in each cycle (cycle

resolved) . The cycle resolved turbulence intensity was found to increase across the flame. The turbulence intensity in the burned gas was found to be homogeneous at the three spatial locations examined and to decay rapidly. There was little or no increase in turbulence intensity ahead of the flame.

941 (DOE/ER/12115–2) **The railplug: Development of a new ignitor for internal combustion engines: Annual report, January 16, 1992–January 15, 1993.** Matthews, R.D.; Nichols, S.P.; Weldon, W.F. Texas Univ., Austin, TX (United States). Oct 1992. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-91ER12115. Order Number DE93003068. Source: OSTI; NTIS; GPO Dep.

The railplug project is essentially divided into three main tasks: (1) Railplug System Development, (II) Application of Railplugs to Engines, and (III) Railplug Durability. Railplug system development is subdivided into two categories: power supply development and ignitor development. In addition to these two categories, there is also a significant amount of work in progress to standardize the evaluation techniques used to measure railplug system performance. These issues are described below. The railplug requires a high voltage spike to breakdown the gap between the rails followed by some sustained voltage to drive the arc down the rails. The power supply chosen is a parallel circuit supply. The parallel circuit utilizes a high voltage (~20 kV) ignition coil in parallel with relatively low voltage (<600 V) capacitors to supply the breakdown and follow-on energies to the plug. The capacitors are charged off of line voltage while an automotive battery and opening switch provide the input to the ignition coil. The circuit is simple, inexpensive, and reliable, but has the drawback of requiring a high voltage diode to isolate the low voltage capacitors from the high voltage impulse. This is not really a single element, but rather consists of many diodes serially connected to achieve a high stand-off voltage. It has a limited average current rating, which means that high rep rates (>~30 Hz) are currently not attainable. The diode also consumes significant amounts of energy. This power supply has consistently discharged railplugs at pressures up to 500 psig.

942 (DTH-LET-RE–92-1) **Natural gas, fuel for a dual-fuel motor.** Energiministeriets Energiforskningsprogram. Miljoe og restprodukter. Frederiksen, P.; Kofoed, E. Danmarks Tekniske Hoejskole, Lyngby (Denmark). Lab. for Energiteknik. Jun 1992. 70p. (In Danish). Contract ENS-1323/88-8. Order Number DE93721476. Source: OSTI; NTIS.

EFP-88.

Measurements were taken in relation to a dual-fuel motor. The motor was a diesel motor with direct fuel injection. The maximum output was 50 kW at 4000/m. Tests showed that this motor could be used as a dual-fuel motor without reduction of the compression ratio, and with no change in maximum output or efficiency in relation to using diesel fuel alone. Exhaust temperature was also the same. The knocking risk judged in relation to acceleration in pressure sequence during combustion was found to be less in the the case of the dual-fuel motor operation. Considerations with regard to emission of NO_x only allow reduced load and operation when the figure for surplus air is 1.8. CO emission under all conditions exceeds the allowed limits. Emission of unburnt hydrocarbons is relatively high, and dependent on the amount of diesel oil used. After-treatment of the exhaust gas is necessary in order to reduce pollutant emission to the accepted standards. (AB).

943 (ORNL/Sub–83-21322/02) **Abrasive wear by coal-fueled diesel engine and related particles.** Ives, L.K. (National Inst. of Standards and Technology, Gaithersburg, MD (United States)). Oak Ridge National Lab., TN (United States); National Inst. of Standards and Technology, Gaithersburg, MD (United States). Sep 1992. 65p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400 ;AI05-83OR21322. (NISTIR–4811). Order Number DE93000834. Source: OSTI; NTIS; GPO Dep.

The development of commercially viable diesel engines that operate directly on pulverized coal-fuels will require solution to the problem of severe abrasive wear. The purpose of the work described in this report was to investigate the nature of the abrasive wear problem. Analytical studies were carried out to determine the characteristics of the coal-fuel and associated combustion particles responsible for abrasion. Laboratory pinon-disk wear tests were conducted on oil-particle mixtures to determine the relationship between wear rate and a number of different particle characteristics, contact parameters, specimen materials properties, and other relevant variables.

3302 External Combustion Engines

944 **Engine system using refrigerant fluid.** Robar, S.; Fraser, D.; Wiley, B. 1 Jul 1992. Filed date 31 Dec 1990. Canada Patent patent application 2033462. 25p. Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN.

An engine system using refrigerant fluid is capable of utilizing the heat produced by an external high-efficiency hydrocarbon fuel combustion process. The heat from that process is utilized to transform the refrigerant fluid from a liquid state to a gaseous state in a cycle which includes extracting work from the fluid in the gaseous state in a high compression ratio piston engine. The cycle further includes transforming the fluid in the gaseous state back to the liquid state in a condenser, and then feeding that fluid under pressure to a heating chamber where the combustion process heat again returns it to the gaseous state at high pressure and temperature. The engine system has a higher efficiency than hydrocarbon fuel combustion engines, and has particular application to use in automobiles. One preferred refrigerant fluid for this engine system is 2,2,dichloro-1,1,1,trifluoro-ethane. 6 figs.

3303 Electric-Powered Systems

Refer also to citation(s) 846

3308 Alternative Fuels

Refer also to citation(s) 846, 943

945 (CONF-9210152–2) **Oil performance in a methanol-fueled vehicle used in severe short-trip service.** West, B.H.; McGill, R.N. Oak Ridge National Lab., TN (United States). [1992]. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 1992 Society of Automotive Engineers (SAE) international fuels and lubricants meeting and exposition; San Francisco, CA (United States); 19-22 Oct 1992. Order Number DE92041264. Source: OSTI; NTIS; GPO Dep.

A methanol and a gasoline vehicle were each subjected to testing under severe short-trip driving conditions. Results show that the cool oil sump temperatures caused more fuel and water to collect in the oil of the methanol vehicle. Protective properties of both vehicles' oils degraded during short trips but rebounded somewhat during a subsequent long trip. Slightly warmer sump temperatures in longer short-trip driving resulted in no methanol dilution in the methanol vehicle's oil, and higher total volatiles contamination in the gasoline vehicle's oil. Freeway driving following the longer short trips promoted less rebound in the degraded oils' protective properties.

946 (DOE/CE–0362P) **Alternative fuel vehicles for the Federal fleet: Results of the 5-year planning process: Executive Order 12759, Section 11.** USDOE Assistant Secretary for Conservation and Renewable Energy, Washington, DC (United States). Aug 1992. 81p. Sponsored by USDOE, Washington, DC (United States). Order Number DE92040587. Source: OSTI; NTIS; GPO Dep.

This report describes five-year plans for acquisition of alternative fuel vehicles (AFVs) by the Federal agencies. These plans will be used to encourage Original Equipment Manufacturers (OEMs) to expand the variety of AFVs produced, reduce the incremental cost of AFVs, and to encourage fuel suppliers to expand the alternative fuel infrastructure and alternative fuel availability. This effort supplements and extends the demonstration and testing of AFVs established by the Department of Energy under the alternative Motor Fuels Act of 1988.

35 ARMS CONTROL

Refer also to citation(s) 264

3501 Policy, Negotiations, and Legislation

Refer also to citation(s) 302, 780

947 (IAEA-INFCIRC–410) **Declaration by the governments of Argentina, Brazil and Chile on the entry into force for them of the treaty of Tlatelolco.** International Atomic Energy Agency, Vienna (Austria). 21 Sep 1992. 2p. Order Number DE93606007. Source: OSTI; NTIS (US Sales Only); INIS.

Hard copies are available in English, French, Russian and Spanish from IAEA Div. of Publications, Distribution Unit.

The document reproduces the text of a declaration by the Governments of Argentina, Brazil and Chile on the entry into force for them of the Treaty for the Prohibition of Nuclear Weapons in Latin America (Treaty of Tlatelolco), made on 26 August 1992 at the VII Special Session of the Agency for the Distribution of Nuclear Weapons in Latin America (OPANAL), held in Mexico City.

3502 Proliferation

948 (DOE/DP/50081–T1) **Prospects for nuclear proliferation rollback: Seminar report.** Yager, J.A. Science Applications International Corp., McLean, VA (United States). 14 Aug 1992. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC01-92DP50081. Order Number DE92040913. Source: OSTI; NTIS; GPO Dep.

On July 22, 1992, the Department of Energy's Office of Arms Control and Nonproliferation sponsored a seminar on prospects for nuclear proliferation rollback. The seminar focused on prospects for nuclear rollback in South Asia and the Middle East. Problems that may exist after rollback were also discussed. This report presents information on: factors involved in rollback decisions, prospects for nuclear rollback in South Asia and the Middle East, and post-rollback problems.(JDB)

3503 Verification

949 (CANADA–93000365) **Bibliography on Arms Control verification, 1962–1991.** Department of External Affairs and International Trade, Ottawa, ON (Canada). Non-Proliferation, Arms Control and Disarmament Div. Oct 1991. 250p. Source: OSTI.

This Bibliography lists alphabetically by author over 1500 documents related to arms control verification. These documents include the publications and submissions of governments and international organizations as well as the academic literature on the subject. Each document has been assigned a number of subject keywords describing its contents. A thesaurus of these keywords is included. Subject access to the documents contained in the Bibliography is provided through an index of these keywords.

950 (SAND–92-1599C) **The detection of organophosphonates by polymer films on a surface acoustic wave device and a micromirror fiber optic sensor.** Hughes, R.C.; Ricco, A.J.; Butler, M.A.; Pfeifer, K.B. Sandia National Labs., Albuquerque, NM (United States). [1992]. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-9207150–1: US-Japan seminar on microfabrication of biosensors, Anchorage, AK (United States), 21-24 Jul 1992). Order Number DE92040964. Source: OSTI; NTIS; GPO Dep.

There is a need for sensitive detection of organophosphonates by, inexpensive, portable instruments. Two kinds of chemical sensors, based on surface acoustic wave (SAW) devices and fiber optic micromirrors, show promise for such sensing systems. Chemically sensitive coatings are required for detection and data for thin films of the polymer polysiloxane are reported for both kinds of physical transducers. Both kinds of sensor are shown to be capable of detecting concentrations of diisopropylmethylphosphonate (DIMP) down to 1 ppM.

36 MATERIALS

Refer also to citation(s) 1127, 2093

3601 Metals and Alloys

Refer also to citation(s) 91, 167, 168, 169, 170, 172, 310, 418, 424, 500, 555, 581, 625, 627, 741, 882, 1040, 1152, 1224, 1227, 1266, 1287, 1456, 2108, 2226, 2227, 2257, 2358, 2386

951 (ANL/CP–76266) **Magneto-optic characterizations of superlattices and wedged sandwiches with oscillatory interlayer magnetic coupling.** Bader, S.D. Argonne National Lab., IL (United States). Jul 1992. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-920762–6: International conference on the physics of transition metals, Darmstadt (Germany), 20-24 Jul 1992). Order Number DE93000607. Source: OSTI; NTIS; GPO Dep.

Three examples of magnetic coupling across metallic spacer layers are considered. Fe/Nb sputtered superlattices are observed to have as many as five antiferromagnetic oscillations, but a weak magnetoresistive anomaly. Epitaxial trilayers of Fe/Mo/Fe grown on Mo(100) and Co/Cu/Co grown on Cu(100) are observed to have short- and long-period oscillations, respectively. The trilayers are grown with wedged spacer layers and characterized in-situ by means of the magneto-optic Kerr effect.

952 (ANL/CP–76413) **Chemical probes of metal cluster structure–Fe, Co, Ni, and Cu.** Parks, E.K.; Zhu, L.; Ho, J.; Riley, S.J. Argonne National Lab., IL (United States). [1992]. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-920921–1: 6. international symposium on small particles and inorganic clusters, Chicago, IL (United States), 16-22 Sep 1992). Order Number DE92041109. Source: OSTI; NTIS; INIS; GPO Dep.

Chemical reactivity is one of the few methods currently available for investigating the geometrical structure of isolated transition metal clusters. In this paper we summarize what is currently known about the structures of clusters of four transition metals, Fe, Co, Ni, and Cu, in the size range from 13 to 180 atoms. Chemical probes used to determine structural information include reactions with $H_2(D_2)$, H_20, NH_3 and N_2. Measurements at both low coverage and at saturation are discussed.

953 (ANL/CP–76999) **The evolution of electronic structure in Al_nCo_m.** Menezes, W.J.C.; Knickelbein, M.B. Argonne National Lab., IL (United States). 16 Sep 1992. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-920921–2: 6. international symposium on small particles and inorganic clusters, Chicago, IL (United States), 16-22 Sep 1992). Order Number DE92040737. Source: OSTI; NTIS; GPO Dep.

The ionization potentials of Al_nCo_m have been bracketed using laser photoionization mass spectrometry. We find that the electronic shell structure observed in the ionization potentials of Al_n by Whetten and coworkers [Phys. Rev. Letters 64, 2539 (1990)] is largely preserved for Al_nCo and Al_nCO_2, and is consistent with cobalt contributing one electron to the conduction band of the cluster. However, with increasing number of cobalt atoms, this simple model breaks down; all vestiges of aluminum cluster electronic shell structure are absent for $m > 4$.

954 (ANL/CP–77178) **Spin structures of Fe/Gd and Fe/Cr multilayers determined by polarized neutron reflectometry.** Loewenhaupt, M. (Forschungszentrum Juelich GmbH (Germany). Inst. fuer Festkoerperforschung); Hahn, W.; Huang, Y.Y.; Felcher, G.P.; Parkin, S.S.P. Argonne National Lab., IL (United States). Aug 1992. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9209227–2: Symposium on magnetic ultrathin films, multilayers, and surfaces, Lyon (France), 7-10 Sep 1992). Order Number DE93000510. Source: OSTI; NTIS; INIS; GPO Dep.

Polarized neutron reflection was used to determine the magnetic structure of two different antiferromagnetically coupled multilayer systems, Fe/Gd and Fe/Cr. In Fe/Gd, the Fe and Gd moments are coupled antiparallel at the interface. At low temperatures a surface

induced magnetic phase transition was found. In Fe/Cr, annealing at temperatures of up to 425°C, resulted in the degrading of antiferromagnetic coupling between Fe layers and in the formation of ferromagnetically coupled regions.

955 (ANL/MSD/CP–77632) **Orientational phase transitions in alloys.** Sabougni, M.L.; Johnson, G.K.; Price, D.L. Argonne National Lab., IL (United States). 22 Sep 1992. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9206202–3: NATO advanced study institute on statics and dynamics of alloy phase transformations, Rhodes (Greece), 21 Jun - 3 jul 1992). Order Number DE93001702. Source: OSTI; NTIS; GPO Dep.

Plastic crystal behavior is observed in semiconducting CsPb and NaSn at high temperature (600 and 500 C, respectively). This behavior is associated with M_4^{4-} or A_4M_4 structural units orientationally disordering about 50 C below the melting point where translational disorder sets in. This orientational disorder is different in the two phases, exhibiting jump reorientations in CsPb and a more isotropic behavior in NaSn. In other Zintl compounds such as KPb, there is a single melting point where orientational and translational disorder sets in simultaneously; the classification of the different Zintl compounds into these two different kinds of behavior will require calorimetry or neutron diffraction below the melting point. (DLC)

956 (BARC–1991/E/011) **Chemical cleaning, decontamination and corrosion.** Gadiyar, H.S. (Bhabha Atomic Research Centre, Bombay (India). Metallurgy Div.); Das Chintamani; Gaonkar, K.B. Bhabha Atomic Research Centre, Bombay (India). 1991. 21p. Order Number DE93605303. Source: OSTI; NTIS (US Sales Only); INIS.

Chemical cleaning of process equipments and pipings in chemical/petrochemical industries is necessitated for improving operation, for preventing premature failures and for avoiding contamination. In developing a chemical formulation for cleaning equipments, the important aspects to be considered include (i) effective removal of corrosion products and scales, (ii) minimum corrosion of the base metal, (iii) easy to handle chemicals and (iv) economic viability. As on date, a wide variety of chemical formulations are available, many of them are either proprietory or patented. For evolving an effective formulation, knowledge of the oxides of various metals and alloys on the one hand and acid concentration, complexing agents and inhibitors to be incorporated on the other, is quite essential. Organic acids like citric acid, acetic acid and formic acid are more popular ones, often used with EDTA for effective removal of corrosion products from ferrous components. The report enumerates some of the concepts in developing effective formulations for chemical cleaning of carbon steel components and further, makes an attempt to suggest simple formulations to be developed for chemical decontamination. (author). 6 refs., 3 fi gs., 4 tabs.

957 (BARC–1991/E/017) **Pulsed laser photoacoustic spectrometer for study of solid materials.** Patel, N.D. (Bhabha Atomic Research Centre, Bombay (India). Spectroscopy Div.); Kartha, V.B. Bhabha Atomic Research Centre, Bombay (India). 1991. 17p. Order Number DE93605290. Source: OSTI; NTIS (US Sales Only); INIS.

The technique of photoacoustic spectroscopy has wide applications bacause it is extremely sensitive, and can be used to obtain spectra in wide spectral range for solids, liquids, gases, solutions, crystals etc. which may be usually difficult by conventional methods. For studying a variety of materials, a pulsed laser photoacoustic spectrometer has been set up in the laboratory. The report discusses the design and performance of the instrument. Some of the spectra of materials like Nd_2O_9 powder, Nd-YAG crystal, $CoCl_2$ $6H_2O$ etc. are shown. A detailed discussion on assignment of the spectra of Nd-YAG is also presented. (author). 4 refs., 5 figs., 1 tab.

958 (CEA-CONF–10998) **Mu SR study of magnetic properties in hydrided $ZrMn_2$.** Baudry, A. (CEA Centre d'Etudes de Grenoble, 38 (France). Dept. de Recherche Fondamentale sur la Matiere Condensee); Boyer, P.; Pontonnier, L.; Miraglia, S.; Harris, W.; Ferreira, L.P. CEA Centre d'Etudes de Grenoble, 38 (France). Direction des Sciences de la Matiere. 1992. 7p. (CONF-9206175–: Interaction symposium on metal-hydrogen systems, Uppsala (Sweden), Jun 1992). Order Number DE93721107. Source: OSTI; NTIS (US Sales Only); INIS.

MuSR measurements in zero field were performed in $ZrMn_2$ and $ZrMn_2H_{3.2}$. The results confirm the existence in the hydride of a sluggish, spin-glass type magnetic transition. The dependence on temperature of the asymmetry of the muon desintegration shows that magnetic ordering begins to take place around 180K, and suggests the existence of clusters of ordered Mn moments. Relaxation effects attributed to fluctuations of clustered magnetic moments are observed in the range 100K-190K.

959 (CEA-CONF–11005) **Microstructural evolution of ferritic-martensitic steels irradiated in the fast breeder reactor Phenix.** Dubuisson, P.; Gilbon, D.; Seran, J.L. CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Direction des Technologies Avancees. 1992. 20p. (CONF-920970–: 3. conference on evolution of microstructure in metals during irradiation, Minett (Canada), 29 Sep - 2 oct 1992). Order Number DE93721679. Source: OSTI; NTIS (US Sales Only); INIS.

This paper deals with the microstructural evolution of a 17Cr ferritic steel (F17) and five stabilized (EM12, FV448, HT9 and 1.4914) or unstabilized (EM10) 9-12Cr ferritic-martensitic steels irradiated in Phenix. The TEM examinations performed on these steels show that their microstructures are only modified by irradiation at low temperature (T<500 deg C). Few voids are generally observed, leading to swelling values close to zero, except in duplex EM12 and ferritic F17 steels. On the other hand, fine and uniform precipitation is induced by irradiation in alloys that contain either more than 13%Cr (α'), either more than 0.3%Ni (M_6C) or ≈2% Mo (χ). This precipitation is mainly responsible for radiation-induced embrittlement which depends both on number density and nature of particles, α' being more detrimental than M_6C or χ. (author). 40 refs., 8 figs., 4 tabs.

960 (CEA-CONF–11035) **Oxide dispersion strengthened ferritic alloys obtained by mechanical alloying: effects of processing on textures and tensile properties.** Alamo, A.; Regle, H.; Bechade, J.L. CEA Centre d'Etudes de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Technologie des Materiaux. 1992. 15p. (CONF-9206195–: 1992 powder metallurgy world congress, San Francisco, CA (United States), 21-26 Jun 1992). Order Number DE93721680. Source: OSTI; NTIS (US Sales Only); INIS.

Textures and tensile properties of two oxide dispersion strengthened (ODS) ferritic alloys (Incoloy MA956 and MA957) obtained by mechanical alloying have been studied as a function of processing. Materials analysed are Fe-based alloys containing 14 and 20%Cr strengthened by yttrium oxide distribution. The object of this paper is to determine the metallurgical and mechanical properties of rod samples obtained by hot extrusion, cold-drawing and swaging. The effect of heat treatments is also discussed. (A.B.). 9 refs., 8 figs., 1 tab.

961 (CEA-CONF–11037) **Tensile and Charpy properties of ferritic-martensitic wrapper steels irradiated in Phenix.** Levy, V.; Fissolo, A.; Dubuisson, P. CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Direction des Technologies Avancees. 1992. 12p. (CONF-9206296–: Specialist Meeting on Cladding and Wrapper Materials, Obninsk (Russian Federation), 7-14 Jun 1992). Order Number DE93721682. Source: OSTI; NTIS (US Sales Only); INIS.

Mechanical properties (tensile and impact strength) on a ferritic steel F17 wrapper (hexagonal tube) and on a ferritic-martensitic steel EM12 irradiated in Phenix are presented. Results show that up to the higher doses investigated (97,3 dpaNRT), the ductile brittle transition temperature remains always below room temperature, and the tensile properties are compatible with their use as wrapper in fast breeder reactors. (A.B.). 8 figs.

962 (CEA-CONF–11038) **Swelling irradiation creep and mechanical properties of Ti-stabilized austenitic steels irradiated as Phenix fuel pins.** Seran, J.L. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Direction des Technologies Avancees); Maillard, A.; Fissolo, A.; Touron, H.; Royer, J.; Martella, T.; Ehrlich, K. CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Direction des Technologies

Avancees. 1992. 19p. (CONF-9206296–: Specialist Meeting on Cladding and Wrapper Materials, Obninsk (Russian Federation), 7-14 Jun 1992). Order Number DE93721683. Source: OSTI; NTIS (US Sales Only); INIS.

Results of dimensional stability and of mechanical behavior of two Ti stabilized austenitic steels (316 and 15Cr-15Ni or AIM1) irradiated up to 115 dpa show a swelling resistance, higher mechanical properties and higher structural stability for 15-15Ti. (A.B.). 5 refs., 13 figs.

963 (CEA-CONF–11039) **Improvement of austenitic steels for cladding applications: the advanced austenitics, out of pile tests and first post-irradiation results.** Seran, J.L. (CEA Centre d'Etudes de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Technologie des Materiaux); Alamo, A.; Dubuisson, P.; Martella, T.; Courcon, P. CEA Centre d'Etudes de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Technologie des Materiaux. 1992. 22p. (CONF-9206296–: Specialist Meeting on Cladding and Wrapper Materials, Obninsk (Russian Federation), 7-14 Jun 1992). Order Number DE93721684. Source: OSTI; NTIS (US Sales Only); INIS.

This paper describes the out of pile and the first post irradiation tests (hardness, tensile strength, creep and microstructure characterizations before or/and after ageing) obtained on several alloys under investigation, to characterize the potential improvement expected on advanced austenitic steels by a reduction of the Cr/Ni ratio from a solute modified or multi stabilized 15Cr-15Ni basis. (A.B.). 3 refs., 16 figs.

964 (CEA-CONF–11040) **Swelling and irradiation creep of ferritic martensitic steels for wrapper application irradiated in Phenix.** Levy, V. (CEA Centre d'Etudes de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Mecanique et de Technologie); Maillard, A.; Touron, H.; Gilbon, D.; Martella, T.; Marinot, R.; Ehrlich, K. CEA Centre d'Etudes de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Mecanique et de Technologie. 1992. 12p. (CONF-9206296–: Specialist Meeting on Cladding and Wrapper Materials, Obninsk (Russian Federation), 7-14 Jun 1992). Order Number DE93721685. Source: OSTI; NTIS (US Sales Only); INIS.

Results of swelling and irradiation creep of F17 ferritic unstabilized steel, of 9CrNbV duplex ferritic martensitic steel and of two martensitic steels (french EM 10 and german DIN 1.4914) show that the best behaviour is obtained on fully martensitic steels for a maximum dose of 147 dpaNRT. (A.B.). 10 figs., 1 tab.

965 (CFFTP-G–9046) **Corrosion of nickel and stainless steels in concentrated lithium hydroxide solutions.** Graydon, J.W. (Toronto Univ., ON (Canada). Dept. of Chemical Engineering and Applied Chemistry); Kirk, D.W. Canadian Fusion Fuels Technology Project, Toronto, ON (Canada). Jun 1990. 35p. Order Number DE93603347. Source: OSTI; NTIS (US Sales Only); INIS.

Preprint of a paper submitted to Corrosion.

The corrosion behaviour of four alloys in 3 and 5 mol/L lithium hydroxide solutions under a hydrogen atmosphere at 95 degrees C was investigated. Corrosion of Nickel 200 and the stainless steels 316, 316L, and E-Brite 26-1 was assessed in two sets of immersion tests lasting 10 and 136 days. Corrosion rates were determined by weight loss, susceptibility to stress corrosion cracking was evaluated using U-bends, and the details of the corrosion process were studied on specimens with a mirror finish using light and electron microscopy, x-ray spectrometry and mapping, and x-ray diffraction. The long term corrosion rates were low for all alloys (< 4 μm/y) and no stress corrosion cracking was observed. The corrosion products on the stainless steels were a thin continuous layer of chromium oxide that provided the passivating protection and well-formed crystals that precipitated from solution onto this layer. The crystals were identified as α-$LiFeO_2$, β-$LiFeO_2$, and a very iron-rich β-$LiFe_5O_8$. The passivating layer on the nickel was $Ni(OH)_2$. The underlying metal corroded evenly except for the 316 stainless steels. These showed a uniform intergranular corrosion with minor drop-out of smaller grains likely because of segregation of impurities to the grain boundaries. The walls of these intergranular crevices were covered with a passivating layer of chromium oxide. (8 figs., 5 tabs., 11 refs.).

966 (CONF-891119–147) **A first-principles study of short range order in Cu-Zn.** Sluiter, M. (Lawrence Berkeley Lab., CA (United States)); Turchi, P.E.A.; Johnson, D.D.; Pinski, F.J.; Nicholson, D.M.; Stocks, G.M. Oak Ridge National Lab., TN (United States). [1989]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400 ;W-7405-ENG-48 ;AC04-76DP00789. From Materials Research Society fall meeting; Boston, MA (United States); 27 Nov - 2 dec 1989. Order Number DE93001366. Source: OSTI; NTIS; INIS; GPO Dep.

Recently, measurements of short range order (SRO) neutron diffuse scattering intensity have been performed on quenched Cu-Zn alloys with 22.4 to 31.1 at.% Zn and pair interactions were obtained by Inverse Monte Carlo simulation. These results are compared to SRO intensities and effective pair interactions obtained from first-principles electronic structure calculations. The theoretical SRO intensities were calculated with the Cluster Variation Method in the tetrahedron-octahedron approximation with first-principles pair interactions as input. More generally, phase stability in the Cu-Zn alloy system are discussed, using ab-initio energetic properties.

967 (CONF-9206202–2) **The direct Monte Carlo method for calculating alloy phases.** Faulkner, J.S. (Florida Atlantic Univ., Boca Raton, FL (United States)); Horvath, E.A.; Wang, Yang; Stocks, G.M. Oak Ridge National Lab., TN (United States). [1992]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400 ;FG05-89ER45392. From NATO advanced study institute on statics and dynamics of alloy phase transformations; Rhodes (Greece); 21 Jun - 3 jul 1992. Order Number DE93000436. Source: OSTI; NTIS; GPO Dep.

Theories exist for predicting the structure of an alloy on the assumption that the energy of the alloy can be obtained from an Ising model Hamiltonian. It is not necessary to introduce interatomic potentials if the Monte Carlo method is used for thermodynamics. δH is calculated directly from the electronic structure of the alloy using the embedded cluster method (ECM) of alloy theory. ECM is based on the coherent potential approximation (CPA) for the electronic states of random substitutional alloys. A version of the theory was developed within the context of the tight-binding model. Cray ymp calculations were made for a 50 - 50 Pd - Rh fcc alloy; electronic energies were obtained using an ECM based on KKR-CPA programs. The top of the miscibility gap is predicted to be at 1415 K. The order parameter vs T graph shows a critical temperature just above 1200 K. Calculations in the grand canonical mode are underway. The calculations are for the fcc lattice, but the bcc lattice is also considered. There are other methods, such as the Harris approximation, that will improve the energy calculations. 4 figs, 15 refs. (DLC)

968 (CONF-9210161–1) **Au(111) and Pt(111) surface phase behavior.** Sandy, A.R. (Massachusetts Inst. of Tech., Cambridge, MA (United States). Dept. of Physics); Mochrie, S.G.J.; Zehner, D.M.; Gruebel, G.; Huang, K.G.; Gibbs, D. Oak Ridge National Lab., TN (United States); Massachusetts Inst. of Tech., Cambridge, MA (United States). [1992]. 12p. Sponsored by USDOE, Washington, DC (United States); National Science Foundation, Washington, DC (United States). DOE Contract AC05-84OR21400 ;AC02-76CH00016. Grant DMR-9119675;Grant DMR-9022933. (CONF-9210162–1: 12. international vacuum congress; 8. international conference on solid surfaces, Hague (Netherlands); Hague (Netherlands), 12-16 Oct 1992; 12-16 oct 1992). Order Number DE92040881. Source: OSTI; NTIS; GPO Dep.

We describe our recent x-ray-scattering studies of the structure and phases of the clean Au(111) and Pt(111) surfaces. Below 0.65 of their respective bulk melting temperatures, the Au(111) surface has a well-ordered chevron reconstruction and the Pt(111) surface is unreconstructed. Above these temperatures, both surfaces reconstruct to form layers that are isotropically compressed and have only short-range order. Throughout their reconstructed phases, the densities of the Au and Pt (111) surfaces increase with increasing temperature.

969 (DOE/ER/12825–1) **Irradiation assisted stress corrosion cracking of austenitic stainless steels: Progress report, September 30, 1988–May 31, 1989.** Was, G.S.; Atzmon, M. Michigan Univ., Ann Arbor, MI (United States). Dept. of Nuclear Engineering. Jun 1989. 6p. Sponsored by USDOE, Washington,

DC (United States). DOE Contract FG07-88ER12825. Order Number DE92040989. Source: OSTI; NTIS; INIS; GPO Dep.

Initial part of the project involved the synthesis of samples for irradiation, and the design and construction of a heating stage for the accelerator target chamber. Effort was made to obtain a grain size of 10 μm. Etching conditions were determined for revealing the grain boundary structure; grain growth results for ultrahigh pure 304 SS with added sulfur are given. 3 figs. (DLC)

970 (DOE/ER/12825–2) **Irradiation-assisted stress corrosion cracking of austenitic alloys: Final report, October 1, 1988–August 31, 1991.** Was, G.S.; Atzmon, M. Michigan Univ., Ann Arbor, MI (United States). Dept. of Nuclear Engineering. [1991]. 39p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG07-88ER12825. Order Number DE92040988. Source: OSTI; NTIS; INIS; GPO Dep.

An experimental program has been conducted to determine the mechanism of irradiation-assisted stress-corrosion cracking (IASCC) in austenitic stainless steel. High-energy protons have been used to produce grain boundary segregation and microstructural damage in samples of controlled impurity content. The densities of network dislocations and dislocation loops were determined by transmission electron microscopy and found to resemble those for neutron irradiation under LWR conditions. Grain boundary compositions were determined by in situ fracture and Auger spectroscopy, as well as by scanning transmission electron microscopy. Cr depletion and Ni segregation were observed in all irradiated samples, with the degree of segregation depending on the type and amount of impurities present. P, and to a lesser extent P, impurities were observed to segregate to the grain boundaries. Irradiation was found to increase the susceptibility of ultra-high-purity (UHP), and to a much lesser extent of UHP+P and UHP+S, alloys to intergranular SCC in 288°C water at 2 ppm O_2 and 0.5 μS/cm. No intergranular fracture was observed in arcon atmosphere, indicating the important role of corrosion in the embrittlement of irradiated samples. The absence of intergranular fracture in 288°C argon and room temperature tests also suggest that the embrittlement is not caused by hydrogen introduced by irradiation. Contrary to common belief, the presence of P impurities led to a significant improvement in IASCC over the ultrahigh purity alloy.

971 (DOE/ER/12825–3) **Irradiation assisted stress corrosion cracking of austenitic stainless steels: Progress report, September 30, 1989–June 30, 1990.** Was, G.S.; Atzmon, M. Michigan Univ., Ann Arbor, MI (United States). Dept. of Nuclear Engineering. Jun 1990. 28p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG07-88ER12825. Order Number DE92040990. Source: OSTI; NTIS; INIS; GPO Dep.

Samples of ultra high purity stainless steel have been fabricated into 2mm x 2mm rectangular bars and irradiated to one dpa ($\sim$l x 10^{19} p^+/cm^2) using 3.4 MeV protons (>20μA) while controlling the sample temperature at 400°C. Samples are pressed onto a water-cooled and electrically heated copper block with a thin layer of Sn in between to improve thermal conductivity. The irradiation produced a significant prompt radiation field but sample activation was limited to β-decay and this decayed rapidly in less than 48 h. Samples were hydrogen charged and strained at slow rates at −30°C insitu in the Auger electron spectrometer to successfully fracture several samples intergranularly for grain boundary composition analysis. An ultra-high purity (UHP) alloy of Fe-19Cr-9Ni was irradiated to 1 dpa at 400C $\pm$ 5C and 7 x 10^{-9} torr in the tandem accelerator of the Michigan Ion Beam Laboratory, resulting in a dislocation network density of 1.8 x 10^9 cm^2 and a dislocation loop density of 7 x 10^{16} cm^{-3} along with the dissolution of small precipitates present in the unirradiated sample. EPR experiments on the UHP irradiated alloy showed no significant increase in charge passed upon reactivation, over an unirradiated sample experiencing the same thermal history. An SCC waterloop and autoclave system has been completed and a sample has been designed to measure the susceptibility of the irradiated microstructure as compared to the unirradiated microstructure.

972 (DOE/ER/45184–T1) **The role of grain boundary chemistry and structure in the environmentally-assisted intergranular cracking of nickel-base alloys: Progress report, August 1, 1991–July 31, 1992.** Was, G.S. Michigan Univ., Ann Arbor, MI (United States). Dept. of Nuclear Engineering. Jul 1992. 32p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-85ER45184. Order Number DE93003126. Source: OSTI; NTIS; GPO Dep.

Stress corrosion cracking tests in constant extension rate tensile (CERT) and constant load tensile (CLT) tests were conducted on Ni-xCr- 9Fe-yC in Ar, water, and a LiOH-boric acid solution. Cr and C improve the resistance of Ni-base alloys to IG cracking in both Ar and water at 360C. Since creep plays a role in IG cracking, one possible explanation for the role of the environment involves its effect on the creep. Experiments were conducted on the role of C in the deformation behavior and failure mode of Ni-16Cr-9Fe. Constant load experiments were conducted on Ni-16Cr-9Fe to determine if the CLT test is more aggressive than CERT. The electron backscattering technique in a SEM is being developed in order to extend the IG cracking studies to grain sizes typical of commercial alloys, 20-30 microns.

973 (DOE/ER/45229–27) **Study of mechanical behavior and internal structure of ferritic nanocrystalline material: Technical progress report, 1 August 1991–1 August 1992.** Weertman, J.R.; Murphy, W.P. Northwestern Univ., Evanston, IL (United States). Dept. of Materials Science and Engineering. Aug 1992. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-86ER45229. Order Number DE92040858. Source: OSTI; NTIS; GPO Dep.

The research thrust of this grant has been directed into two areas. The principal effort has been spent in an investigation of the synthesis, mechanical behavior and internal structure of ferritic nanocrystalline material. A second effort involves a study of the high temperature behavior of several ferritic steels. In particular, we are investigating the precursors and earliest stages of fatigue crack initiation, especially how initiation is affected by hold times and by environment.

974 (DOE/ER/45253–7) **Potential modulation of equilibrium and excitation phenomena at the electrolyte-solid interface: Progress report, October 31, 1991–September 30, 1992.** Furtak, T.E. Colorado School of Mines, Golden, CO (United States). Dept. of Physics. Oct 1992. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-86ER45253. Order Number DE93001685. Source: OSTI; NTIS; GPO Dep.

Optical SHG (second harmonic generation) is well suited for interfacial studies and for probing the electrolyte-solid interface. A series of experiments were completed on Ag(001). The bulk isotropic (γ) and anisotropic (ζ) susceptibilities were determined and can be carried over to other Ag orientations. The only allowed surface susceptibility, $\chi(zxx)$, was negligible only as long as the surface was uncharged or negatively charged. To explain the results, a phenomenological model has been developed for four-field mixing; the static electrochemical field is a third "incoming field" (together with the two optical SHG fields) that mix via a third-order surface susceptibility. The potential-induced surface reconstruction on Ag(111), attributed last year to adsorbed sulfate ions, was studied further; the reproducibility problem in the trend toward the fully reconstructed surface continued to be found. Alternate explanations for the apparent symmetry change are being explored. The detection system on the surface Raman facility was improved. (DLC)

975 (DOE/ER/45308–6) **Novel concepts in weld science: Role of gradients and composite structure: Technical progress report, June 1, 1990–August 31, 1992.** Matlock, D.K.; Olson, D.L. Colorado School of Mines, Golden, CO (United States). Center for Welding and Joining Research. 31 Aug 1992. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-87ER45308. (MT-CWJR–092-023). Order Number DE92040893. Source: OSTI; NTIS; GPO Dep.

The effects of compositional and microstructural gradients on weld metal properties were investigated. The effects of compositional gradients were analyzed using thermodynamic and composite models. Brittle and ductile cracking behavior were investigated using both binary alloy single crystals and large grain castings. In both cases, the crack propagated along regions where the compositional gradients were the steepest. High temperature deformation

of large wavelength compositonally modulated structures vas investigated to understand creep behavior in veld metal. At moderate temperatures, the creep behavior of cored materials was found to follow predictions based on the rule of mixtures composite analysis. At higher temperatures with the advent of dynamic mass transport the creep process is influenced by diffusion-promoted vacancy flow and time-dependent compositional gradient. The investigation found the critical gradient which will promote Kirkendall voids and has reported a creep rate behavior that suggests strong structural dependence, localized stress and vacancy transport influence. Weld metal, based on metal matrix composite, was also demonstrated.

976 (DOE/ER/45346–T1) **Deformation twinning in ordered alloys transformation induced ductility in intermetallics: Final report.** Goo, E. University of Southern California, Los Angeles, CA (United States). Dept. of Materials Science and Engineering. Sep 1992. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG03-88ER45346. Order Number DE93002879. Source: OSTI; NTIS; GPO Dep.

Intermetallics, which are ordered alloys, have excellent high temperature strength. Unfortunately a universal problem facing intermetallics is the lack of ductility. This program attempted to look at some novel solutions for enhancing ductility in intermetallics. Deformation twinning has been demonstrated in TiNi to be responsible for its ductility. This was a surprising result since twinning was not believed to occur readily in ordered alloys. Furthermore the twinning occurred on a (114) plane which had not been previously observed. Research into determining the mechanisms for twinning in ordered alloy and understanding how twinning enhances the ductility of intermetallic was studied. Martensitic transformations in many intermetallics also provides a possible means of enhancing ductility. The detwinning of martensite twins or transformation induced martensite provides a mechanism for accommodating large strains. It is known that a metastable martensitic phase may be created by quenching a non-stoichiometric NiAl alloy. This presents the potential of substantial ductility in NiAl. Investigation of the martensitic phase transformation and its effect on the ductility of NiAl alloys was investigated.

977 (DOE/ER/45414–T1) **Influence of point defects on grain boundary diffusion in oxides: [Annual report, July 1, 1990–March 1, 1992].** Stubican, V.S. Pennsylvania State Univ., University Park, PA (United States). Dept. of Materials Science and Engineering. 15 Mar 1991. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-90ER45414. Order Number DE93002864. Source: OSTI; NTIS; GPO Dep.

The influence of point defects on grain boundary diffusion of Co ions in NiO was studied using polycrystalline films and bicrystals. Grain boundary diffusion was studied at 750 C at oxygen partial pressure. Two diffusion regions were found. At low oxygen pressures, extrinsic diffusion was observed. Above oxygen pressure of 10^{-7}, influence of intrinsic point defects was detected. It was determined that grain boundary diffusion was > 3 orders of magnitude faster than volume diffusion. However, it seems that grain boundary diffusion is influenced by the point defects in a similar way as the volume diffusion. 4 figs.

978 (DPW–5420) **Trip report: Argonne National Laboratory, April 10, 1952.** Montenyohl, V.I. Du Pont de Nemours (E.I.) and Co., Wilmington, DE (United States). Explosives Dept. 30 Apr 1952. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-76SR00001. (SR/H–227). Order Number DE93001460. Source: OSTI; NTIS (US Sales Only); GPO Dep.

In a meeting held to discuss the proposed corrosion testing program and its aims, Frank Foote indicated that both were reasonable, While the heat treatment yielding the maximum corrosion resistance if different from that which would be used for maximum dimensional stability, Foote felt that an improvement in dimensional stability by alloying would very likely show a parallel improvement in corrosion resistance; while it might not be possible to attain the maximum in corrosion resistance and the maximum in dimensional stability simultaneously in the same alloy system, there is no reason to fear that attainment of good corrosion resistance will be at the price of dimensional stability. Stability might not be at its maximum, but it still will be better than in natural uranium.

979 (DPW–5911) **Visit to the Los Alamos Scientific Laboratories radiography: Trip report.** McKeehan, M. Du Pont de Nemours (E.I.) and Co., Wilmington, DE (United States). Explosives Dept. 25 Jul 1952. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-76SR00001. (SR/H–211). Order Number DE93001238. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report discusses a visit to Los Alamos Scientific Laboratories at the University of California to determine the best values for the several parameters connected with x-radiography of aluminium welds. The report is dated July 25, 1952. (JL)

980 (ENEL-CRTN-G11–91-11) **Computer code for evaluation of creep and damage: Validation through experimental data.** Garzillo, A.; Meriggi, M.; Sampietri, C. Centro Informazioni Studi Esperienze (CISE), Milan (Italy); Ente Nazionale per l'Energia Elettrica, Milan (Italy). Centro Termica e Nucleare. 1991. 9p. Order Number DE93729476. Source: OSTI; NTIS (US Sales Only); INIS.

The two-dimensional finite element computer code AUDACE, for non-linear mechanical problems, is presented. This code was developed in order to analyze thermo-elasto-plastic and creep problems in the framework of continuum damage mechanics. The simulation of a large cylindrical pressure vessel with a fully circumferential crack was performed to check the capabilities of the code. The computed results are compared with the experimental ones. This work was carried out under an ENEL (Italian Electricity Board)-CISE collaboration programme.

981 (EUR–13647/III, pp. 733-758) **The use of lithium-bearing geothermal fluids for the industrial production of lithium.** Fouillac, C. (Bureau de Recherches Geologiques et Minieres (BRGM), 45 - Orleans (France)); Marabini, M.; Niccolini, M. Commission of the European Communities, Luxembourg (Luxembourg). 1992. In *Summary reports of the R and D programme: primary raw materials (1986-89) - Volume III.* 1046p. Order Number DE93720867. Source: OSTI; NTIS (US Sales Only); INIS.

In the french and italian geothermal aquifers actually in production or with a predicted development, an estimation is made of the lithium reserves. Data on water composition, and two methods of lithium extraction are presented (specific electrode and aluminium precipitation). (A.B.). 10 refs., 14 figs., 2 tabs.

982 (IGC–114) **Biennial activity report of metallurgy programme for 1987 and 1988.** Shanmugam, V.; Rao, B.P.C.; Bhanu Sankara Rao, K.; Muralidharan, P.; Bhaduri, A.K.; Kuppusami, P.; Shyamsunder, M.T.; Sampath, N.; Sreedharan, O.M. (eds.). Indira Gandhi Centre for Atomic Research, Kalpakkam (India). 1990. 459p. Order Number DE93605263. Source: OSTI; NTIS (US Sales Only); INIS.

The research and development (R and D) activities in the field of metallurgy at Indira Gandhi Centre for Atomic Research, Kalpakkam during 1987-1988 are reported in the form of individual summaries arranged under headings : (1) Mechanical Metallurgy Section, (2) Physical Metallurgy Section, (3) Chemical Metallurgy Section, (4) Materials Technology Section, (5) Division for PIE and NDT Development and (6) Quality Engineering Section. A list of publications by the staff scientists working in the field of metallurgy during report period is given in one of the appendices. (author). figs., tabs.

983 (IGC–119) **A review of hot cracking in austenitic stainless steel weldments.** Shankar, V.; Gill, T.P.S.; Mannan, S.L.; Rodriguez, P. Indira Gandhi Centre for Atomic Research, Kalpakkam (India). 1991. 83p. Order Number DE93605280. Source: OSTI; NTIS (US Sales Only); INIS.

The occurrence of hot cracking in austenitic stainless steel weldments is discussed with respect to its origin and metallurgical contributory factors. Of the three types of hot cracking, namely solidification cracking, liquation and ductility dip cracking, solidification cracking occurs in the interdendritic regions in weld metal while liquation and ductility dip cracking occur intergranularly in the heat-affected zone (HAZ). Segregation of impurity and minor elements such as sulphur, phosphorous, silicon, niobium, boron etc to form low melting eutectic phases has been found to be the major cause of hot cracking. Control of HAZ cracking requires minimisation of impurity elements in the base metal. In stabilized stainless steels containing niobium, higher amounts of delta-ferrite have been

found necessary to prevent cracking than in unstabilized compositions. Titanium compounds have been found to cause liquation cracking in maraging steels and titanium containing stainless steels and superalloys. In nitrogen added stainless steels, cracking resistance decreases when the solidification mode changes to primary austenitic due to nitrogen addition. A review of the test methods to evaluate hot cracking behaviour showed that several external restraint and semi-self-restraint tests are available. The finger Test, WRC Fissure Bend Test, the PVR test and the Varestraint Test are described along with typical test results. Hot ductility testing to reveal HAZ cracking tendency during welding is described, which is of particular importance to stabilized stainless steels. Based on the literature, recommendations are made for welding stabilized and nitrogen added steels, indicating areas of further work. (author). 81 refs., 30 figs., 1 tab.

984 (IGC–122) **Compatibility studies of AISI type 316 stainless steel with lead-lithium eutectic alloy.** Joseph, A.; Kasiviswanathan, K.V.; Raj, Baldev. Indira Gandhi Centre for Atomic Research, Kalpakkam (India). 1991. 71p. Order Number DE93605281. Source: OSTI; NTIS (US Sales Only); INIS.

Spent fuel subassemblies from the Fast Breeder Test Reactor (FBTR) are to be stored in leak tight cotainers until they are required to be sent for reprocessing. Use of advanced fuels like uranium carbides and plutonium carbides, which are known to be highly chemically active with oxygen and moisture demands adequate leak tightness during long term storage to avoid undesirable chemical reactions. Use of low melting alloys which acts as liquid/solid sealants in the storage containers in which fuel subassemblies are to be kept is being considered for this purpose. Lead-lithium (0.7 wt % lithium) eutectic alloy was chosen as one of the candidate alloys for the purpose on the basis of theoretical assessments. The candidate sealing alloy should have good compatibility with the structural materials of fuel subassemblies as well as the fuel and fission products. AISI type 316 stainless steel in solution annealed, ten and twenty percent cold worked condition is the clad and wrapper material used for the fabrication of fuel pins and subassemblies. Compatibility studies between eutectic Pb-Li alloy and AISI type 316 stainless steel material in the above conditions were undertaken at different temperatures and time durations. The studies indicate that the tensile properties of AISI type 316 stainless steel are not subject to any serious jeopardisation through contact with this molten Pb-Li eutectic alloy for periods extending even upto 7000 hours at 873 K. Thus use of Pb-Li eutectic alloy would be suitable for the storage of irradiated fuel. (author). 16 refs., 38 figs., 3 tabs.

985 (INFO–0379) **Hydrogen absorption-desorption at metal surfaces.** Ward, C.A.; Pataki, L. Atomic Energy Control Board, Ottawa, ON (Canada). Apr 1991. 59p. Project 2.174.1;Contract 87055-9-4053/01-SZ. Order Number DE93603259. Source: OSTI; NTIS (US Sales Only); INIS.

It is proposed that when zirconium oxide (ZrO_2) is exposed to hydrogen at 300 degrees C or higher, a reaction occurs to produce metallic zirconium and water, thereby increasing the electrical conductivity of the oxide film and its permeability to hydrogen. Experiments have been performed in which Zr and Zr-2.5% Nb were either hydrided or deuterided in a furnace between 300 C and 800 C and in an atmosphere that consisted primarily of either hydrogen or deuterium. After cooling a specimen to room temperature, it was placed in a thermogravimetric analyzer that was equipped with a mass spectrometer, TGA-MS. Each specimen was then heated to 1200 C at a controlled rate in a primarily helium atmosphere monitored with the mass spectrometer. Light water evolved from the hydrided specimens and heavy water from the deuterided ones and there was a weight loss of the specimens that accompanied the water evolution. The specimens having approximately the same amount of hydride but more oxide also evolved more H_2O, and that the H_2O did not come from reactions between impurity H_2 and O_2 in the TGA-MS. Heating a zirconium or zirconium alloy specimen that contains a hydride or deuteride phase within and an oxide layer on its surface causes the hydrogen to diffuse toward the surface and when it encounters the oxide a reaction follows that produces water. The conventional mechanism for the dissipation of the imperviousness of ZrO_2 to H_2 that results from the oxide being exposed to a reducing atmosphere will not explain the water production observed in these experiments. However, the existence of the proposed reaction can account for the elevated hydrogen concentration in an oxide film that has been observed to accompany the aqueous corrosion of zirconium and the effects on both the electrical conductivity and hydrogen permeability that (Abstract Truncated)

986 (INIS-BR–2933, pp. 218) **Obtainment of tantalum powder for electrolytic capacitors.** Freitas, D. de (Fundacao de Tecnologia Industrial (FTI), Lorena, SP (Brazil). Centro de Materiais Refratarios); Pinatti, D.G.; Gomes, U.U. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. CAPACITORS/materials; TANTALUM/chemical preparation; CAPACITORS; MATERIALS; POWDERS; REDUCTION; TANTALUM

987 (INIS-BR–2933, pp. 223) **Study on phase diagram of $YO_{1.5}$-CuO_x binary.** Silva Machado, A.J. da (Fundacao de Tecnologia Industrial (FTI), Lorena, SP (Brazil). Centro de Materiais Refratarios); Andrade, A.J.P.; Jardim, R.F. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. YTTRIUM COMPOUNDS/phase diagrams; COPPER OXIDES; TEMPERATURE RANGE 1000-4000 K; TITRATION; X-RAY DIFFRACTION

988 (INIS-BR–2933, pp. 237) **Study on magnetic hyperfine interactions in Co_2YZ type Heusler alloys (Y = Tl, V and Z = Ge,Sl,Sn).** Carbonari, A.W. (Instituto de Pesquisas Energeticas e Nucleares (IPEN), Sao Paulo, SP (Brazil)); Saxena, R.N.; Pendl Junior, W.; Attili, R.N. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. HEUSLER ALLOYS/hyperfine structure; COBALT ALLOYS; CURIE POINT; DIFFERENTIAL PAC; GAMMA CASCADES; HAFNIUM 181; STOICHIOMETRY; TANTALUM 181; TEMPERATURE RANGE 0065-0273 K

989 (INIS-BR–2933, pp. 223) **Crystallographic study on plastic deformation of copper monocrystals.** Padua, C.G. de (Universidade Estadual de Londrina, PR (Brazil). Dept. de Fisica); Medrano, R.E. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

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990 (INIS-BR–2933, pp. 224) **Study on mechanical properties of $Y_2Cu_2O_5$ and $BaCuO_2$ type sintered materials.** Peres, M.P. (UNESP, Guaratingueta, SP (Brazil). Faculdade de Engenharia); Silva Machado, A.J. da; Vernilli Junior, F.; Gomes, U.U. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. SINTERED MATERIALS/tensile properties; COPPER; HARDNESS; IMPACT STRENGTH; SINTERING; TEMPERATURE DEPENDENCE; YTTRIUM

991 (INIS-BR–2933, pp. 228) **Energy shift in gold-palladium alloys investigated by XPS and XAES.** Nascente, P.A.P. (Universidade Estadual de Campinas, SP (Brazil). Dept. de Fisica Aplicada); Castro, S.G.C. de; Landers, R.; Kleiman, G.G. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. GOLD ALLOYS/isomer shift; PALLADIUM ALLOYS/isomer shift; BINARY ALLOY SYSTEMS; AUGER ELECTRON SPECTROSCOPY; ELECTRON TRANSFER; KINETIC ENERGY; PHOTOELECTRON SPECTROSCOPY; VALENCE; X RADIATION

992 (INIS-BR–2933, pp. 221) **Thermal and electric properties of laminated and hydrogenous palladium.** Queiroz, R.S. (Universidade Estadual de Campinas, SP (Brazil). Inst. de Fisica); Medina Neto, A.; Bento, A.C.; Vargas, H.; Miranda, L.C.M.; Gandra, F.C.C. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. PALLADIUM/hydrogenation; ELECTRIC CONDUCTIVITY; HYDROGEN; LAMELLAE; PALLADIUM; HYDROGENATION; THERMAL CONDUCTIVITY; THERMAL DIFFUSIVITY; X-RAY SPECTRA

993 (INIS-BR–2933, pp. 228) **Magnetic and structural characterization of FeCo-V/Nb compounds.** Rezende, M.F.S. (Minas Gerais Univ., Belo Horizonte, MG (Brazil)); Mansur, R.A.; Persiano, A.I.C. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

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994 (INIS-BR–2933, pp. 229) **Susceptibility and AC resistivity of Cr-V alloys bombardment.** Oliveira, A.J.A. de (Sao Carlos Univ., SP (Brazil). Dept. de Fisica); Gelfuso, V.C.; Ortiz, W.A.; Camargo, P.C. de. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. ALLOY SYSTEMS/magnetic susceptibility; CHROMIUM; ELECTRIC CONDUCTIVITY; NEEL TEMPERATURE; VANADIUM

995 (INIS-BR–2933, pp. 239) **Anelastic relaxations in polycrystals and monocrystals of Nb-Zr alloys.** Grandini, C.R. (UNESP, Bauru, SP (Brazil). Dept. de Fisica); Botta Filho, W.J.; Florencio, O.; Tejima, H.; Jordao, J.A.R. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. NIOBIUM ALLOYS/internal friction; ZIRCONIUM ALLOYS/internal friction; HYDROGENATION; MONOCRYSTALS; POLYCRYSTALS; RELAXATION

996 (INIS-BR–2933, pp. 258) **Dispersion of third order susceptibility phase of doped glass with semiconductors.** Ma, H. (Pernambuco Univ., Recife, PE (Brazil). Dept. de Fisica); Acioli, L.H.; Gomes, A.S.L.; Araujo, C.B. de. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. DOPED MATERIALS/magnetic susceptibility; CADMIUM SELENIDES; CADMIUM SULFIDES; CRYSTALS; GLASS; POLARIZATION; SEMICONDUCTOR MATERIALS

997 (INIS-BR–2933, pp. 298) **Interpretation of variation with the temperature and the magnetic field of Cr^{3+} fluorescence mean-life in $GdAlO_3$.** Helman, J.S. (Centro Brasileiro de Pesquisas Fisicas (CBPF), Rio de Janeiro, RJ (Brazil)); Caride, A.O.; Basso, H.C.; Terrile, M.C.; Carvalho, R.A. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. FLUORESCENCE/lifetime; ALUMINIUM; CHROMIUM IONS; EXCHANGE INTERACTIONS; FLUORESCENCE; LIFETIME; GADOLINIUM; MAGNETIC FIELDS; OXYGEN; TEMPERATURE DEPENDENCE; TEMPERATURE RANGE 0000-0013 K

998 (INIS-BR–2933, pp. 217) **Studies on dielectric properties of anodic films in metallic valves.** Holanda, J.N.F. de (Fundacao de Tecnologia Industrial (FTI), Lorena, SP (Brazil). Centro de Materiais Refratarios); Gomes, U.U. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. ANODIZATION/films; FILMS/dielectric properties; ALUMINIUM; ANODIZATION; FILMS; CAPACITORS; MOLYBDENUM; NIOBIUM; TANTALUM; TITANIUM

999 (INIS-BR–2933, pp. 305) **Electric quadrupole oscillation spectrum of ^{59}Co in YCo_3.** Fontes, M.B. (Centro Brasileiro de Pesquisas Fisicas (CBPF), Rio de Janeiro, RJ (Brazil)); Guimaraes, A.P.; Graham, R.G.; Riedi, P.C. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. COBALT ALLOYS/e2-transitions; POLYCRYSTALS/nmr spectra; YTTRIUM ALLOYS/e2-transitions; E2-TRANSITIONS; COBALT 59; MAGNETIC FIELDS; POLYCRYSTALS; SPIN ECHO; TEMPERATURE RANGE 0000-0013 K

1000 (INIS-BR–2933, pp. 318) **Hydrogenated germanium and silicon amorphous alloys ($a\text{-}Si_{1-x}Ge_x:H$).** Oliveira Graeff, C.F. de (Universidade Estadual de Campinas, SP (Brazil)); Chambouleyron, I. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. HYDROGEN/deposition; AMORPHOUS STATE; ELECTRO-OPTICAL EFFECTS; GERMANIUM ALLOYS; HYDROGEN; DEPOSITION; INFRARED SPECTRA; SILICON ALLOYS; SPUTTERING; TEMPERATURE DEPENDENCE

1001 (INIS-BR–2933, pp. 356) **Magnetic and transport properties in the $(Nd_{1-x}Gd_x)_{1.85}Ce_{0.15}CuO_{4-y}$ system.** Jardim, R.F. (Sao Paulo Univ., SP (Brazil). Inst. de Fisica); Westphal, C.H.; Beverra, C.C.; Paduan Filho, A. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics,

Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. COPPER OXIDES/magnetic susceptibility; COPPER OXIDES/x-ray diffraction; CERIUM; ELECTRIC CONDUCTIVITY; GADOLINIUM; MAGNETIC FIELDS; NEODYMIUM; QUANTITY RATIO; SAMPLE PREPARATION; TEMPERATURE DEPENDENCE

1002 (INIS-BR–2933, pp. 368) **Coadsorption of oxygen with hydrocarbons on Pd(111) studied by low energy electron diffraction and spectroscopy.** Nascente, P.A.P. (Universidade Estadual de Campinas, SP (Brazil). Inst. de Fisica); Hove, M.A.V.; Somorjai, G.A. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. HYDROCARBONS/adsorption; OXYGEN/adsorption; PALLADIUM/sorptive properties; ELECTRON DIFFRACTION; ELECTRON SPECTROSCOPY; HYDROCARBONS; ADSORPTION; LAYERS; OXYGEN; PALLADIUM; SURFACES; TEMPERATURE RANGE 0273-0400 K

1003 (INIS-BR–2942, pp. 99-100) **Creep rupture behaviour of a cruciform specimen submitted to a triaxial tensile stress state.** Goncalves Filho, O.J.A. (Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores). Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1989. 147p. (In Portuguese). (CONF-8901202–: PACAM '89: 1st Pan American congress of applied mechanics, Rio de Janeiro (Brazil), Jan 1989). In *Triennial technical report - 1986, 1987, 1988 - Instituto de Engenharia Nuclear (IEN) -Dept. of Reactors (DERE).* Order Number DE93605069. Source: OSTI; NTIS (US Sales Only); INIS.

Published in full form as CT-DIMEC 06/88.

Published in summary form only. MECHANICAL STRUCTURES/creep; MECHANICAL STRUCTURES/ruptures; FINITE ELEMENT METHOD; CREEP; RUPTURES; STRESSES

1004 (INIS-BR–2942, pp. 93) **Analysis and verification of CTS-1 IEN/CNEN sodium loop design stresses in normal and emergency conditions.** Correia Filho, A. (Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores). Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1989. 147p. (In Portuguese). In *Triennial technical report - 1986, 1987, 1988 - Instituto de Engenharia Nuclear (IEN) -Dept. of Reactors (DERE).* Order Number DE93605069. Source: OSTI; NTIS (US Sales Only); INIS.

Published in full form as CT-DIMEC 02/87.

Published in summary form only. COOLANT LOOPS/stresses; COOLANT LOOPS/thermal analysis; STRESSES; DRAINAGE; FINITE ELEMENT METHOD; SODIUM; STANDARDIZATION; TANKS; THERMODYNAMICS

1005 (JINR-E–2-90-258) **Investigation of tungsten and lead structural materials activation by 1.0-1.1 GeV protons.** Barashenkov, V.S. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation); Sosnin, A.N.; Pankov, V.M. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Computing Techniques and Automation. 1991. 12p. Order Number DE93605311. Source: OSTI; NTIS (US Sales Only); INIS.

Abilities of computer program complex CASCADE developed in Dubna are illustrated on the example of simulation of induced γ-activity, produced in tungsten and lead targets under high energy protons irradiation. Abilities and direction of further improvement of the model are discussed. 7 refs.; 3 figs.; 3 tabs.

1006 (JINR-E–2-91-137) **Applicability of cascade-evaporation model to the calculation of radiation damages due to ions with energies T>1 GeV.** Barashenkov, V.S.; Polanski, A.; Sosnin, A.N.; Shmakov, S.Yu. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Computing Techniques and Automation. 1991. 6p. Order Number DE93605264. Source: OSTI; NTIS (US Sales Only); INIS.

Using an example of inelastic collisions of ^{12}C ions with nuclei at 1.02 GeV the accuracy of cascade-evaporation model in prediction of properties of nuclear fragments and recoil nuclei, which make a main contribution in the radiation damage in semi-and superconductors, is analyzed. However some of its features concerning the production of moderately heavy fragments and corresponding to approximately 1% in inelastic interaction cross-section (and to small contribution of radiation damages respectively) contradiet qualitatively the model prediction and indicate the influence of some esentially different mechanism of reaction. 4 refs.; 7 figs.

1007 (JINR-R–2-91-242) **Mathematical simulation of the induced γ-radiation in structural materials of spaceships. Time dependence.** Barashenkov, V.S. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation); Sosnin, A.N.; Taranenko, P.I.; Fedotov, S.N. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Computing Techniques and Automation. 1991. 10p. (In Russian). Order Number DE93605312. Source: OSTI; NTIS (US Sales Only); INIS.

Basing on an internuclear model and a computer programme for induced gamma-radiation activity calculation, the time-dependence of the gamma-background intensity, induced by cosmic radiation in structural materials Al, Ti, Fe, Cu, W, Pb and in one of the alloys at different periods. A table of gamma-emitters, making the main contribution at short and long durations of the flight is presented. 1 ref.; 8 figs.; 1 tab.

1008 (KAERI/RR–1076/91) **Study on the causes of failures in the Titanium tubes of condensers of nuclear power plant.** Kim, Uh Chul (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Kim, Joung Soo; Chung, Han Sub; Hur, Do Hang; Hwang, Seong Sik. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Jan 1992. 109p. (In Korean). Order Number DE93605304. Source: OSTI; NTIS (US Sales Only); INIS.

This report is the result of galvanic corrosion tests among Al-brass, carbon steel and Ti, and hydrogen embrittlement of Ti tubes. The scopes of the project are hydrogen embrittlement, the effect of oxide layer on Ti model condenser tests, drop tests, and galvanic corrosion tests. The summary of the results is as follows: (1) The optimum cathodic protection potential of Ti tube was determined between -0.9V vs. SCE and -0.75V vs. SCE. (2) Mechanical properties and thermal diffusivity are not so affected by the oxide film formed on Ti. (3) As the cathodic potential and the flow rate decreased, absorbed hydrogen content increased. And cathodic protection current decreased very sharply along the tube axis away from the position where the tube is protected intensively. (4) As the area ratio of anode to cathode decreased, the corrosion rate of anode (carbon steel) increased, even at very low cathodic potential (-1.5V vs.SCE) applied to the carbon steel. (Author).

1009 (KAERI/RR–1079/91) **Study on the improvement of the properties of Zr alloys.** Kim, Young Suk (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Han, Jung Ho; Jeong, Yong Hwan; Lee, Duk Hyun; Park, Gi Sung; Hong, Jun Hwa; Park, Ji Yun; No, Gae Ho. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Jan 1992. 143p. (In Korean). Order Number DE93605265. Source: OSTI; NTIS (US Sales Only); INIS.

(1) The objective of this study is to develop the corrosion resistant zirconium base alloys. In order to achieve this goal, this year's activities have focused on the guidelines for the corrosion resistant zirconium alloy design, the manufacturing of the sheets of zirconium base alloys and finally the characterization of the NAZAs (New Alternate Zirconium alloys). The main results from this study can be summarized as follows: (2) Based on the evaluation of the role of alloying elements, i.e., Nb, Sn, Fe, Cr, and etc, as many as 23 different kinds of the NAZAs were preliminarily designed. (3) The 3 kinds of the NAZAs-Lot 15, 22 and 23 manufactured into a sheet though a series of manufacturing procedures. (4) The microstructures, hardness and the corrosion performances of 3 kinds of NAZAs were investigated. (Author).

1010 (LA-UR–92-1982) **Models of high velocity impact phenomena.** Wingate, C.A.; Stellingwerf, R.F.; Davidson, R.F.;

Burkett, M.W. Los Alamos National Lab., NM (United States). [1992]. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-921221–1: High velocity impact symposium, Austin, TX (United States), Dec 1992). Order Number DE92017452. Source: OSTI; NTIS; GPO Dep.

Models of craters formed by impacts at velocities of up to 27 km/sec have been computed using the Smooth Particle Hydrodynamics, MESA, EPIC and CALE codes. These modeling efforts will be compared to data obtained from the Hypervelocity Microparticle Impact project at Los Alamos using the van de Graaff accelerator. This work aids in understanding the fine features and scaling laws found in the experimental results.

1011 (LA-UR–92-3130) **Physics of YbBiPt.** Thompson, J.D. (Los Alamos National Lab., NM (United States)); Canfield, P.C.; Lacerda, A.; Hundley, M.F.; Fisk, Z.; Ott, H.R.; Felder, E.; Chernikov, M.; Maple, M.B.; Visani, P.; Seaman, C.L.; Lopez de la Torre, M.A.; Aeppli, G. Los Alamos National Lab., NM (United States). 15 Sep 1992. 13p. Sponsored by USDOE, Washington, DC (United States); National Science Foundation, Washington, DC (United States). DOE Contract W-7405-ENG-36. Grant DMR-91-07698. (CONF-9209202–2: International conference on strongly correlated electron systems, Sendai (Japan), 7-11 Sep 1992). Order Number DE93000853. Source: OSTI; NTIS; INIS; GPO Dep.

YbBiPt has a low temperature linear specific heat coefficient of 8J/mole-Yb K^2 and a small specific-heat anomaly at 0.4K. We discuss new experiments on specific-heat of diluted YbBiPt, and magnetic field dependent effects and electrical resistivity in pure YbBiPt. We argue that in this material the Kondo and crystal-field energy scales are small and of comparable magnitude, placing YbBiPt in the same class as many Uranium heavy-electron compounds.

1012 (LBL–30937) **Quantum Monte Carlo methods and lithium cluster properties.** Owen, R.K. Lawrence Berkeley Lab., CA (United States). Dec 1990. 122p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. Order Number DE92041163. Source: OSTI; NTIS; GPO Dep.

Properties of small lithium clusters with sizes ranging from n = 1 to 5 atoms were investigated using quantum Monte Carlo (QMC) methods. Cluster geometries were found from complete active space self consistent field (CASSCF) calculations. A detailed development of the QMC method leading to the variational QMC (V-QMC) and diffusion QMC (D-QMC) methods is shown. The many-body aspect of electron correlation is introduced into the QMC importance sampling electron-electron correlation functions by using density dependent parameters, and are shown to increase the amount of correlation energy obtained in V-QMC calculations. A detailed analysis of D-QMC time-step bias is made and is found to be at least linear with respect to the time-step. The D-QMC calculations determined the lithium cluster ionization potentials to be 0.1982(14) [0.1981], 0.1895(9) [0.1874(4)], 0.1530(34) [0.1599(73)], 0.1664(37) [0.1724(110)], 0.1613(43) [0.1675(110)] Hartrees for lithium clusters n = 1 through 5, respectively; in good agreement with experimental results shown in the brackets. Also, the binding energies per atom was computed to be 0.0177(8) [0.0203(12)], 0.0188(10) [0.0220(21)], 0.0247(8) [0.0310(12)], 0.0253(8) [0.0351(8)] Hartrees for lithium clusters n = 2 through 5, respectively. The lithium cluster one-electron density is shown to have charge concentrations corresponding to nonnuclear attractors. The overall shape of the electronic charge density also bears a remarkable similarity with the anisotropic harmonic oscillator model shape for the given number of valence electrons.

1013 (LBL–32095) **The influence of deformation-induced martensite on the cryogenic behavior of 300-series stainless steels.** Morris, J.W. Jr.; Chan, J.W.; Mei, Z. Lawrence Berkeley Lab., CA (United States). Jun 1992. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-920614–4: International cryogenic engineering conference and the international cryogenic materials conference, Kiev (Ukraine), 8-12 Jun 1992). Order Number DE92041208. Source: OSTI; NTIS; INIS; GPO Dep.

The 300-series stainless steels that are commonly specified for the structures of high field superconducting magnets are metastable austenitic alloys that undergo martensitic transformations when deformed at low temperature. The martensitic tranformation is promoted by plastic deformation and by exposure to high magnetic fields. The transformation significantly influences the mechanical properties of the alloy. The mechanisms of this influence are reviewed, with emphasis on fatigue crack growth effects and magnetomechanical phenomena that have only recently been recognized.

1014 (LBL–32290) **Crystallography of Co/Pt multilayers and nanostructures.** Zhang, Bing (Lawrence Berkeley Lab., CA (United States)); Krishnan, K.M.; Farrow, R.F.C. Lawrence Berkeley Lab., CA (United States). Apr 1992. 24p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-920450–1: 4. conference on frontiers of electron microscopy in materials science, Oakland, CA (United States), 21-24 Apr 1992). Order Number DE92041212. Source: OSTI; NTIS; GPO Dep.

Atomically engineered nanostructures and multilayers of Co/Pt exhibit strong perpendicular anisotropy. This unique property, that determines their potential as a magneto-optic recording media, is dependent on a variety of microstructural parameters that include the overall crystallography, thickness of the layers, orientation, defect formation, interface reactions etc. A series of Co/Pt multilayer samples with different thickness of the Co layer were studied by electron diffraction. It has been determined that the Co layers persists in the fcc structure up to a thickness of 50 Å. As the thickness is varied fmm 3Å to 50Å in the multilayers, the Co film gradually relaxed to its bulk lattice parameter. (111) twinning and lattice strain at the interfaces between Pt and Co layers are also observed. The symmetry forbidden reflections observed at 1/3 (224) positions in (111) zone diffraction patterns of the multilayer are due to (111) twinning and compositional modulations along the multilayer growth direction.

1015 (LBL–32390) **The effect of low Au concentrations on the properties of eutectic Sn/Pb.** Kramer, P.A. Lawrence Berkeley Lab., CA (United States). May 1992. 81p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. Order Number DE92041206. Source: OSTI; NTIS; GPO Dep.

This study was of the effects moderately low Au concentrations ($\leq$ 10 wt%) have on the mechanical properties and microstructure of an eutectic Sn/Pb alloy. Vibration (60–90 Hz swept sine wave for 30 hours) and thermal cycling (0–110C for 1450 cycles) reliability tests were performed on fine pitch leaded chip carriers using eutectic Sn/Pb solder on PCBs (printed circuit boards) with 0, 5, 10, 20, and 50μin nominal Au thicknesses. Testing was also performed on double shear creep specimens consisting of arrays of regular pitch joints. There was a dramatic increase in the number of joints containing voids with increasing Au concentration, an effect more pronounced in the creep joints than in the reliability joints. These voids tended to coalesce and grow during rework simulation of the reliability joints. $AuSn_4$ intermetallics present in toe of 4.8 wt% (50 μin) Au vibration joints rotated from initial vertical perpendicular to surface of PCB metallization, solidification positions to roughly horizontal (parallel to plating surface) orientations during rework simulation and during aging of the parts. The $AuSn_4$ intermetallics in the toe of the 4.8 wt% (50μin) Au reflowed joints also rotated after vibration testing. No joint failures were observed in either vibration tested or thermally cycled specimens. Cracks formed in some of the vibration tested specimen joints under the heel of the gull-wing lead at Pb-rich phases. Thermally cycled specimens showed eutectic microstructure and intermetallic coarsening without crack formation. Creep tests showed loss of the superplasticity in eutectic Sn/Pb alloys with even the lowest Au concentration tested of 0.2 wt% Au. Intermetallic rotation was not a factor in crack propagation, but void presence was. Cracks tended to form in joints containing voids before forming in void-free joints. Crack propagation followed Sn/Sn grain boundaries and Sn/Pb phase boundaries from Pb-rich phase to Pb-rich phase.

1016 (LBL–32400) **Nucleation and growth in electrodeposition of thin copper films on pyrolytic graphite.** Kinaci, F.S.; Muller, R.H. Lawrence Berkeley Lab., CA (United States). May 1992. 152p. Sponsored by USDOE, Washington, DC (United

States). DOE Contract AC03-76SF00098. Order Number DE92041216. Source: OSTI; NTIS; GPO Dep.

Electrodeposition of Cu on graphite electrodes was studied, with emphasis on nucleation. Various ex-situ and in-situ methods were investigated for determining the number density of nuclei. Two direct methods were studied (scanning electron microscopy and scanning tunneling microscopy); indirect determinations included Raman spectroscopy and analysis of potentiostatic current transients. Though some of the techniques correctly predicted the nucleation densities under special conditions, SEM was the most reliable tool. The large scatter in the data necessitated steps to minimize this effect. To electrodeposit Cu on graphite, a nucleation overpotential of 250 mV was measured with cyclic voltammetry; such a large overpotential does not occur on a Pt or on a Cu-covered graphite electrode. The deposition potential is the dominant parameter governing nucleation density. There is a sharp increase in the nucleation density with applied potential. Cu can be deposited on highly oriented pyrolytic graphite only between the nucleation overpotential and the hydrogen evolution potential. To increase the Cu nucleation density, while avoiding excessive H evolution, a double pulse potential technique was used; nucleation densities on the order of 10^{10} nuclei/cm^2 were achieved. The use of inhibitors (PVA, benzotriazole) was also investigated. Deposition on conducting polymer electrodes was also studied; initial results with polyaniline show promise. 57 figs, 6 tabs, refs. (DLC)

1017 (LBL–32483) **A Boltzmann-equation approach to the magnetoresistance of ferromagnetic-normal metallic multilayers.** Falicov, L.M.; Hood, R.Q. Lawrence Berkeley Lab., CA (United States). Jun 1992. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-9209227–1: Symposium on magnetic ultrathin films, multilayers, and surfaces, Lyon (France), 7-10 Sep 1992). Order Number DE92041213. Source: OSTI; NTIS; GPO Dep.

The Boltzmann equation is solved for a system consisting of a ferromagnetic - normal - ferromagnetic metallic trilayer. The in-plane conductance of the film is calculated for two configurations: the ferromagnetic layers aligned (i) parallel and (ii) antiparallel to each other. The results explain the giant negative magnetoresistance encountered in these systems when an initial antiparallel arrangement is changed into a parallel configuration by application of an external magnetic field. A large negative magnetoresistance requires, in general, considerable asymmetry in the interface scattering for the two spin orientations.

1018 (LBL–32711) **Low-temperature specific heat of YMn_2 in the paramagnetic and antiferromagnetic phases.** Fisher, R.A. (Lawrence Berkeley Lab., CA (United States)); Emerson, J.P.; Phillips, N.E.; Ballou, R.; Lelievre-Berna, E. Lawrence Berkeley Lab., CA (United States). Jul 1992. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-920762–5: International conference on the physics of transition metals, Darmstadt (Germany), 20-24 Jul 1992). Order Number DE93000570. Source: OSTI; NTIS; GPO Dep.

The low-temperature specific heat of YMn_2 has been measured at applied pressures of 0 to 7.7 kbar. A paramagnetic state is stabilized for moderate values of the applied pressure (of the order of 1.6 kbar). A large linear term in the specific heat, which decreases regularly with increasing pressure, is observed in this phase. It is ascribed to giant spin fluctuations associated with a magnetic-non magnetic instability and a strong geometrical spin frustration.

1019 (LBL–32715) **Quasiparticle properties of Ge(111)-2 × 1 surface.** Zhu, X.; Louie, S.G. Lawrence Berkeley Lab., CA (United States). Aug 1992. 4p. Sponsored by USDOE, Washington, DC (United States); National Science Foundation, Washington, DC (United States). DOE Contract AC03-76SF00098. Grant DMR-9120269. (CONF-920825–1: 21. international conference on the physics of semiconductors, Beijing (China), 10-14 Aug 1992). Order Number DE93000574. Source: OSTI; NTIS; INIS; GPO Dep.

We have studied from first principles the quasiparticle properties of the 2 × 1 reconstructed (111) surface of Ge. Quasiparticle energies are calculated using the GW expansion of the electron self energy operator. The calculations explain a spectrum of experimental results obtained from photoemission, inverse photoemission, optical absorption, scanning tunneling microscopy, etc., for this surface. We also present a quasiparticle theory for the photoelectric threshold and examine the effects of many body corrections for this quantity.

1020 (SAND–92-1289C) **Modeling of the vacuum plasma spray process.** Varacalle, D.J. Jr. (Idaho National Engineering Lab., Idaho Falls, ID (United States)); Neiser, R.A.; Smith, M.F. Sandia National Labs., Albuquerque, NM (United States). [1992]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789 ;AC07-76ID01570. (CONF-9206135–8: 1992 international thermal spray conference, Orlando, FL (United States), 1-5 Jun 1992). Order Number DE93000718. Source: OSTI; NTIS; GPO Dep.

Experimental and analytical studies have been conducted to investigate gas, particle, and coating dynamics in the vacuum plasma spray (VPS) process for a tungsten powder. VPS coatings were examined metallographically and the results compared with the model's predictions. The plasma was numerically modeled from the cathode tip to the spray distance in the free plume for the experimental conditions of this study. This information was then used as boundary conditions to solve the particle dynamics. The predicted temperature and velocity of the powder particles at standoff were then used as initial conditions for a coating dynamics code. The code predicts the coating morphology for the specific process parameters. The predicted characteristics exhibit good correlation with the observed coating properties.

1021 (SAND–92-1769C) **Generation of aerosolized particulate contamination by the wear of stainless steels.** McIntyre, D.C.; Dugger, M.T.; Rader, D.J. Sandia National Labs., Albuquerque, NM (United States). [1992]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-9210125–2: Microcontamination '92, Santa Barbara, CA (United States), 23-30 Oct 1992). Order Number DE93000742. Source: OSTI; NTIS; GPO Dep.

Pin-on-disc testing was used to generate wear particles from 304 and 440C stainless steels in presence of low-velocity interfacial air flows from a laminar flow bench. The aerosolized wear generated particles were studied using optical particle counters. In some cases, the particles were also collected using an electrostatic precipitator. The tests showed that 440C pins in unlubricated sliding contact with 440C discs and 304 discs generated mostly submicron particles, but that many of these submicron particles were detached from the wear surfaces as parts of agglomerated macro-particles.

1022 (SKB-TR–91-60) **Spent fuel corrosion and dissolution.** Forsyth, R.S. (Studsvik AB, Nykoeping (Sweden)); Werme, L.O. Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden). Dec 1991. 60p. Order Number DE93603349. Source: OSTI; NTIS; INIS.

This paper presents the current status of the Swedish programme for the study of the corrosion of spent fuel in bicarbonate groundwaters. Results from the on-going experimental programme are presented and compared with the data base accumulated over the past ten years. Release of uranium and the other actinides was solubility-controlled under the semi-static type of experiments performed. The limiting solubility for uranium under oxic conditions was consistent with the hypothesis that the redox potential of the system is assumed to correspond to the U_3O_7/U_3O_8 transition. The measured release fractions for ^{137}Cs, ^{90}Sr and ^{99}Tc are discussed and used to exemplify the probable dissolution and corrosion processes involved. A substantial part of the Swedish programme is directed to the characterization of spent fuel before and after corrosion tests. Recent results are presented on the identification of possible corrosion sites. (26 refs.) (au).

1023 (SKB-TR–91-62) **The kinetics of pitting corrosion of carbon steel applied to evaluating containers for nuclear waste disposal.** Marsh, G.P. (Strategic Studies Dept., AEA Technology, Harwell Lab. (United Kingdom)); Taylor, K.J.; Harker, A.H. Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden). Jul 1991. 73p. Order Number DE93603350. Source: OSTI; NTIS; INIS.

This is the final summary report on a project, funded by SKB, investigating the pitting corrosion of carbon steel containers for high level nuclear waste or spent reactor fuel under granite disposal

conditions. The study has covered a statistically based experimental programme to establish the pit growth kinetics, and a modelling study to determine the maximum pitting period subsequent to repository closure. It is shown that the rate of pit propagation is slower than that suggested by earlier work and that the maximum pitting period is only a small fraction of the target container life of 1000 years. An illustrative example of the methodology for estimating the corrosion allowance needed to prevent pit penetration is given. This could be applied to specific repository conditions as defined by SKB. Finally some limited recommendations are made for further studies to test and validate the methodology. (au).

1024 (SKB-TR--91-63) **An electrochemistry-based model for the dissolution of UO_2.** Shoesmith, D.W. (AECL Research, Whiteshell Labs., Pinawa, MB (Canada)); Sunder, S. Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden). Dec 1991. 108p. Order Number DE93603351. Source: OSTI; NTIS; INIS.

A model to predict dissolution of UO_2 fuel under both oxidizing and nonoxidizing conditions is compared with other available models for fuel dissolution. Dissolution rates under oxidizing conditions are predicted by extrapolating steady-state electrochemical currents for anodic dissolution of UO_2 to the corrosion potentials measured in solutions containing various oxidants, including dissolved oxygen, hydrogen peroxide, and products of gamma or alpha radiolysis of water. Where possible, the predictions are compared with dissolution rates measured chemically and available in the literature. With a few exceptions, agreement between predictions and published rates is good. For nonoxidizing conditions, dissolution rate of UO_2 is not well known. Attempts to measure this rate are fraught with difficulties, and the published values are difficult to rationalize within the framework of our model. Consequently, we briefly reviewed the literature on dissolution of similar p-type semiconducting oxides and chose to estimate the chemical dissolution rate of UO_2 by analogy to the well-studied oxide NiO. In this manner we have managed to establish a threshold rate below which the rate of oxidative dissolution becomes negligible in comparison with the rate of chemical dissolution. This threshold agrees quite well with that established electrochemically. Using these extrapolated rates we predict that the rate for oxidative dissolution of CANDU (CANada Deuterium Uranium) fuel due to gamma radiolysis will fall below this threshold after $\approx$ 200 a, a time period that is short in comparison with the anticipated lifetimes of titanium waste containers, which are expected to last for a period greater than $\approx$ 1200 a. For dissolution due to alpha radiolysis, oxidative rates are uncertain, but could be above this threshold for a period of 500 to 10000 a for CANDU fuel, and 500 to 30000 a for pressurized water reactor (PWR) fuel.

1025 (SKB-TR--92-04) **Low temperature creep of copper intended for nuclear waste containers.** Henderson, P.J. (Swedish Inst. for Metals Research, Stockholm (Sweden)); Oesterberg, J.O.; Ivarsson, B. Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden). Mar 1992. 36p. Order Number DE93603242. Source: OSTI; NTIS; INIS.

Creep tests have been carried out on oxygen-free high purity copper (Cu-OF) oxygen-free phosphorus copper (Cu-OFP) and oxygen-free copper containing 0.15 wt% Ag (Cu-OFS) at temperatures between 180 and 450 degrees C. Some Cu-OF batches exhibited poor ductility and ruptured at creep strains of less than 1% while another batch produced acceptable ductility values of about 10% elongation at fracture. These differences in ductility were attributed to a combination of sulphur content and grain size. Specimens of Cu-OFP and Cu-OFS ruptured at creep strains of 30% or greater. It was speculated that small additions of P or Ag could increase the solid solution of S in copper and therefore reduce the risk of grain boundary segregation and embrittlement or that an element like P co-segregates with S and competes for grain boundary sites. (au).

1026 (UCRL-JC--109382) **Improvement in the synthesis of Ni/Ti neutron mirrors.** Jankowski, A.F. Lawrence Livermore National Lab., CA (United States). Jun 1992. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-920792--37: Society of Photo-Optical Instrumentation Engineers (SPIE) international symposium on optical applied science and engineering, San Diego, CA (United States), 19-24 Jul 1992). Order Number DE93001322. Source: OSTI; NTIS; GPO Dep.

Improvement in the as-deposited structure of Ni/Ti multilayers is achieved through optimization of the sputter deposition process. In the as-deposited condition, these Ni/Ti multilayers are well suited for very high reflectivity (>95%) neutron supermirror application. Smooth layering is produced with compositionally abrupt interfaces yielding an effective roughness less than 1nm. The deposition parameters are controlled to produce a near thermalized condition for the sputtered neutrals. The Ni/Ti multilayer system is not structurally stable, however, when subject to moderate heating (>300°C) or irradiation. The in-use degradation of interface structure from neutron irradiation may be a limitation for the Ni/Ti system.

1027 (UCRL-JC--110724) **First-principles approach to alloy phase stability.** Turchi, P.E.A.; Reinhard, L.T.; Sluiter, M. Lawrence Livermore National Lab., CA (United States). 22 May 1992. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-920762--7: International conference on the physics of transition metals, Darmstadt (Germany), 20-24 Jul 1992). Order Number DE93001323. Source: OSTI; NTIS; GPO Dep.

Order-disorder phenomena and structural transformations in substitutional alloys are studied with a proper combination of quantum mechanics and statistical thermodynamics. The methodology is briefly presented and its predictive capabilities are illustrated for various alloys, including the bcc-based Ti-V, Ti-Fe and Cr-Fe systems, in terms of electronic structure, ground-state and short-range order diffuse scattering properties, and finally phase diagram results.

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Refer also to citation(s) 158, 174, 2191, 2195, 2197

1028 (ANL/CP--76328) **Progress toward application of bulk high-T_c superconductors.** Poeppel, R.B.; Dorris, S.E.; Joo, J.; Kaufman, D.Y.; Lanagan, M.T.; Prorok, B.C.; Singh, J.P.; Wu, C.T.; Goretta, K.C. Argonne National Lab., IL (United States). Aug 1992. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-920916--1: 3. international conference and exhibition of the world congress on superconductivity, Munich (Germany), 14-19 Sep 1992). Order Number DE92040735. Source: OSTI; NTIS; GPO Dep.

Ag-clad wires have been fabricated from $Bi_2Sr_2CaCu_2O_x$, $Bi_{1.8}Pb_{0.4}Sr_2Ca_2Cu_3O_x$, and $TlBa_2Ca_2Cu_3O_x$ superconductors by powder- in-tube techniques. Critical current densities of 1×10^5 A/cm^2 at 4.2 K and 3×10^4 A/cm^2 at 77 K have been obtained. Additions of particulate Ag have been used to improve mechanical properties and promote partial melting during heat treatment. The processing sequences for the compounds had many common features, but also significant differences. The effects of processing on microstructure and properties will be discussed.

1029 (ANL/CP--77169) **Local critical current measurements on $(Bi,Pb)_2Sr_2Ca_2Cu_3O_x$ tape with an electromagnetic probe.** Telschow, K.L. (EG and G Idaho, Inc., Idaho Falls, ID (United States)); O'Brien, T.K.; Lanagan, M.T.; Kaufman, D.Y. Argonne National Lab., IL (United States); EG and G Idaho, Inc., Idaho Falls, ID (United States). 24 Aug 1992. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38 ;AC07-76ID01570. (EGG-M--92184;CONF-920802--11: Applied superconductivity conference, Chicago, IL (United States), 23-28 Aug 1992). Order Number DE92041133. Source: OSTI; NTIS; INIS; GPO Dep.

The ability to measure critical currents in high $T_c$superconducting tapes on a local scale is valuable for optimizing the fabrication process. This paper describes the use of induced currents from a small noncontacting electromagnetic probe to determine the critical current density in a $(Bi,Pb)_2Sr_2Ca_2Cu_3O_x$/Ag tape on a local scale. The technique forces full field penetration into the tape locally and infers the critical current density from the Bean critical state model, accounting for the Ag overlayers. Critical current images of the till can be obtained by scanning the probe over the tape surface with

spatial resolution on the order of 1.0 mm. Results for tapes with different microstructures we discussed.

1030 (ANL/CP–77183) **Processing high-$T_c$superconductors with GeV heavy ions.** Marwick, A.D. (International Business Machines Corp., Yorktown Heights, NY (United States). Thomas J. Watson Research Center); Civale, L.; Krusin-Elbaum, L; Worthington, T.K.; Holtzberg, F.; Wheeler, R.; Kirk, M.A.; Thompson, J.R.; Sun, Y.R.; Kerchner, H.RArgonne National Lab., IL (United States). [1992]. 29p. Sponsored by USDOE, Washington, DC (United States); National Science Foundation, Washington, DC (United States). DOE Contract W-31109-ENG-38. Contract STC-8809854. (CONF-9209200–3: 8. international conference on ion beam modification of materials, Heidelberg (Germany), 7-11 Sep 1992). Order Number DE92040755. Source: OSTI; NTIS; INIS; GPO Dep.

Irradiation of high-$T_c$superconducting crystals with low doses (10^{10}–10^{11} ions/cm^2) of GeV heavy ions (0.58 GeV Sn-116; 1.0-GeV Au-197) produces a unique microstructure consisting of discrete amorphous columns which are only a few nm in diameter but tens of microns long. It has been found recently that this columnar microstructure causes larger increases in magnetization and critical current at high temperature and high magnetic field than other types of defects in these materials. This can be understood as a consequence of the effective pinning of magnetic vortex lines provided by the columnar defects. Measurements confirm that the pinning is strongest when the magnetic field is aligned with the ion tracks. Differences in the pinning in different materials can be related to differences in their anisotropy, which affects the structure of the vortices and their pinning at columnar defects.

1031 (ANL/CP–77430) **Current transport across grain boundaries in $TlBa_2Ca_2Cu_3O_x$ thick polycrystalline films and $YBa_2Cu_3O_7$ step edges.** Hettinger, J.D. (Argonne National Lab., IL (United States)); Kim, D.H.; Miller, D.J.; Hu, J.G.; Gray, K.E.; Sharping, J.E.; Daly, K.; Pettiett-Hall, C.; Tkaczyk, J.E.; Deluca, J. Argonne National Lab., IL (United States). Aug 1992. 5p. Sponsored by USDOE, Washington, DC (United States); National Science Foundation, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-920802–21: Applied superconductivity conference, Chicago, IL (United States), 23-28 Aug 1992). Order Number DE93000610. Source: OSTI; NTIS; GPO Dep.

We have performed transport measurements in magnetic fields (H//c) up to 10T on a series of $YBa_2Cu_3O_7$ grain boundaries induced by epitaxial growth on a substrate containing a series of step edges. For this material we find an activation energy which goes as $U(T)\sim(1-t)$. Electric field versus current density curves taken at a constant temperature while varying the magnetic field allows a determination of the magnetic field dependence of the activation energy using the Ambagaokar-Halperin Model. These values agree with results extracted from the resistive transitions. Similar characterizations of a sample of $TlBa_2Ca_2Cu_3O_x$ are also presented. The temperature dependence of the activation energy for this system may be summarized as $U(T)\sim(1-t)^2$, suggesting that the grain boundaries behave as SNS juctions.

1032 (ANL/CP–77431) **Effect of substrate-twin-induced microstructure on transport properties of epitaxial $Tl_2Ba_2CaCu_2O_x$ films in a magnetic field.** Kim, D.H. (Argonne National Lab., IL (United States)); Miller, D.J.; Hettinger, J.D.; Gray, K.E.; Landis, P.G.; Sharping, J.E.; Eddy, M. Argonne National Lab., IL (United States). Aug 1992. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-920802–18: Applied superconductivity conference, Chicago, IL (United States), 23-28 Aug 1992). Order Number DE93000605. Source: OSTI; NTIS; GPO Dep.

The role of substrate-induced microstructure on transport properties in c-axis oriented epitaxial $Tl_2Ba_2CaCu_2O_x$ films grown on $LaAlO_3$ and $SrTiO_3$ has been studied. For a magnetic field parallel to the Cu-0 planes, resistivity and the critical current density, J_c, have been measured as a function of angle θ between the applied field and the direction of transport current. Resistivity dips and enhancement of the critical current density, J_c, were observed for magnetic fields applied parallel to the substrate twins in $LaAlO_3$ in high fields ($\geq$ 2 T). Meanwhile for films on $SrTiO_3$, resistivity and J_c were Lorentz-force independent.

1033 (ANL/CP–77432) **Enhanced superconducting properties in $Bi_2Sr_2Ca_1Cu_2O_y$ by thermal and mechanical processing.** Miller, D.J.; Holesinger, T.G.; Hettinger, J.D.; Goretta, K.C.; Gray, K.E. Argonne National Lab., IL (United States). Aug 1992. 5p. Sponsored by USDOE, Washington, DC (United States); National Science Foundation, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-920802–22: Applied superconductivity conference, Chicago, IL (United States), 23-28 Aug 1992). Order Number DE93000609. Source: OSTI; NTIS; GPO Dep.

The practical application of high temperature superconductors has been limited by low transport currents in bulk samples. The effect of processing on transition temperature, grain boundary coupling, and flux pinning has been examined for $Bi_2Sr_2Ca^1Cu_{,2}O_y$. Enhancement of $T_c$based on composition can be achieved by control of crystallization and subsequent annealing processes while thermo-mechanical processing may be used to modify weak link and flux pinning behavior. The microstructural basis for these changes are related to the composition of the superconducting phase and the presence of defects associated with deformation processing. The implications of these results on conductor development are related to the selection of alloy composition for optimum transition temperature and controlled thermo-mechanical processing which yields a uniform defect structure.

1034 (ANL/CP–77433) **Scaling laws for the critical current density of NbN films in high magnetic fields.** Hampshire, D.P. (Durham Univ. (United Kingdom). Dept. of Physics); Gray, K.E.; Kampwirth, R.T. Argonne National Lab., IL (United States). Aug 1992. 8p. Sponsored by USDOE, Washington, DC (United States); University Funding Council (United States); Science and Engineering Council (United States). DOE Contract W-31109-ENG-38. (CONF-920802–20: Applied superconductivity conference, Chicago, IL (United States), 23-28 Aug 1992). Order Number DE93000604. Source: OSTI; NTIS; GPO Dep.

We have measured the critical current density (Jc) of two NbN films (500 Å and 1550 Å thick) as a function of temperature in magnetic fields up to 25 Tesla using transport measurements. In both films, the functional form of the volume pinning force F_p obeys the Fietz - Webb scaling law throughout the entire magnetic field and temperature range such that: $F_p=J_c \times B= \alpha B_{c2}{}^m(T)b^{\frac{1}{2}}(1-b)^2 = \alpha^*(1-T/T_c)^m b^{\frac{1}{2}}(1-b)^2$ where α and α^* are constants dependent on the film, $B_{c2}(T)$ is the upper critical field, $b = B/B_{c2}(T)$ is the reduced magnetic field, $T_c$is the critical temperature and we find $m = 2.7 \pm 0.1$. Over a limited range of magnetic fields close to $B_{c2}(T)$, we can approximate this functional form by: $F_p = BB_{c2}{}^M(T)b(1-b)^2=B^*(1-T/T_c)^M b(1-b)^2$ where B and B* are constants and we find $M = 2.6\pm0.2$. Values of J_c derived from D.C. magnetisation data obtained using Bean's model show qualitative agreement with the transport measurements throughout the superconducting phase. Despite the marked granularity in the microstructure of these films, we interpret our results as evidence that a flux pinning mechanism determines the transport current density in NbN films in high magnetic fields.

1035 (BNL–47891) **Large magnetic field induced fluctuation effect in superconducting $Bi_2Sr_2Ca_2Cu_3O_{10}$ tape.** Li, Q. (Brookhaven National Lab., Upton, NY (United States)); Suenaga, M.; Hikata, T.; Sato, K. Brookhaven National Lab., Upton, NY (United States). [1992]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-920802–12: Applied superconductivity conference, Chicago, IL (United States), 23-28 Aug 1992). Order Number DE92041314. Source: OSTI; NTIS; GPO Dep.

We present our study on the magnetic field induced fluctuation effect in a highly textured $Bi_2Sr_2Ca_2Cu_3O_{10}$ tape, based on the magnetization measurement. Extremely large induced excess diamagnetism in high fields was observed at temperatures down to 75 K. In weak fields, fluctuation significantly reduces the diamagnetism of this system just below T_c. The role of this large extended fluctuation effect played in the application of Bi-based superconductor family is discussed.

1036 (CEAC-R–1-91) **Preparation of high temperature superconductor ceramics using cuban reactives. Optimization of**

the synthesis method. Leyva Fabelo, A. (Centro de Estudios Aplicados al Desarrollo Nuclear (CEADEN), La Habana (Cuba)); Cruz, C.; Aragon, B.; Suarez, J.C.; Mora, M. Comision de Energia Atomica, La Habana (Cuba). 1991 13p. (In Spanish). Order Number DE93603355. Source: OSTI; NTIS (US Sales Only); INIS.

Results of the crystallographic characterization of a group of Cuban Products, which are evaluated to be employed in HTSC fabrication are presented in this paper. The first results on the synthesis of HTSC ($RBa_2Cu_3O_{7\delta}$, R= Y, La, Nd) using Cuban reactives, are presented. The so called 'solid state reaction method of synthesis' was optimized, obtaining a critical temperature of more than 93 k.

1037 (CONF-9209200–2) **Ion implantation effects in silicon carbide.** McHargue, C.J. (Tennessee Univ., Knoxville, TN (United States)); Williams, J.M. Oak Ridge National Lab., TN (United States). Aug 1992. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 8. international conference on ion beam modification of materials; Heidelberg (Germany); 7-11 Sep 1992. Order Number DE92041306. Source: OSTI; NTIS; GPO Dep.

Results from a program, on ion implantation effects in α and β silicon carbide will be summarized. Silicon carbide is easily amorphized by ion implantation at room temperature. Amorphization as determined by Rutherford backscattering spectrometry (RBS) occurs for damage energies of about 20 eV/atom, corresponding to 0.2 to 0.3 displacements per atom (dpa), at room temperature. Implantation at higher temperatures (≈500°C or above) does not produce an amorphous region for damage levels as high as 17 dpa. Recovery of damage at the subamorphous damage level is fairly complete by 1000°C. Epitaxial regrowth after amorphization occurs over a very narrow temperature range at ≈1500°C in an almost "explosive" fashion. Damage and amorphization are accompanied by swelling of up to 15%. The hardness and elastic modulus values of amorphous SiC are 40% and 70%, respectively, of the unimplanted single crystalline values, but before amorphization, the hardness first increases during the early damage phase and then decreases upon amorphization. The oxidation and chemical etching rates of the amorphous state are higher than for crystalline material. Amorphization kinetics, annealing kinetics and property changes are broadly compatible with the idea of a critical accumulation model for amorphization.

1038 (DOE/ER/45372–5) **Energetics, bonding mechanism and electronic structure of metal/ceramic interfaces: Annual progress report, April 1, 1992–March 31, 1993.** Freeman, A.J. Northwestern Univ., Evanston, IL (United States). Dept. of Physics and Astronomy. [1993]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-88ER45372. Order Number DE93003121. Source: OSTI; NTIS; GPO Dep.

Progress are reported on: electronic structure of PdO, PtO, and AgO (band structure calculations); ab initio calculations of electronic structure of TiO_2(110) surface; and electronic structure of VO_2 and TiO_2 thin films and multilayers. (DLC)

1039 (DOE/ER/45400–T4) **Mechanisms of mechanical fatigue in ceramics: Annual technical progress report No. 2, August 15, 1990–August 14, 1991.** Cox, B. Rockwell International Corp., Thousand Oaks, CA (United States). Science Center. Oct 1992. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG03-89ER45400. (SC–71014.ATR). Order Number DE93001726. Source: OSTI; NTIS; GPO Dep.

This report covers work done in the second twelve month period of our initial two-year contract on "Mechanisms of Mechanical Fatigue in Ceramics." A large portion of our work in that period consisted of developing the theory of bridged cracks, with especial emphasis on interpreting fatigue and fracture experiments in terms of micromechanical mechanisms. In the experimental area, we shifted our focus away from room temperature tests of metal reinforced ceramics such WC/Co to high temperature testing of fibrous composites. We also participated in a major review of experimental progress in the fatigue of ceramic materials through an international conference, edited proceedings, and a published review.

1040 (DOE/ID/12949–T1) **Evaluation of cerium oxide coated Cu cermets as inert anodes for aluminum electrowinning: Final report, August 1990–March 1992.** ELTECH Research Corp., Fairport Harbor, OH (United States). Aug 1992. 149p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC07-90ID12949. Order Number DE92019333. Source: OSTI; NTIS; GPO Dep.

Cu/$NiFe_2O_4$ cermets were evaluated, with and without an in-situ deposited CEROX (TM; cerium oxide) coating, in 100 h laboratory A1 electrowinning tests. Bath ratio and current density were varied between tests and corrosion was determined by contamination of the aluminum and cryolite by cermet components (Cu, Fe, and Ni). Higher bath ratios of 1.5 to 1.6 led to less corrosion and thicker CEROX coatings. Lower current densities led to slightly less corrosion but much less oxidation of the Cu cermet substrate. At identical test conditions, the corrosion of the CEROX coated cermets was 1/7 that of an uncoated cermet. Corrosion was increased in CEROX coated cermets tested under unsaturated alumina conditions. The electrical conductivity of the CEROX coating was measured to be ~0.2 $ohm^{-1}cm^{-1}$, resulting in a slight voltage penalty, depending on the thickness of the coating.

1041 (DOE/PC/91309–T5) **High temperature alkali corrosion of ceramics in coal gas: Quarterly progress report No. 4, June 1, 1992–August 31, 1992.** Pickrell, G.R.; Sun, T.; Brown, J.J. Virginia Polytechnic Inst. and State Univ., Blacksburg, VA (United States). Center for Advanced Ceramic Materials. 29 Aug 1992. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-91PC91309. Order Number DE93000902. Source: OSTI; NTIS; GPO Dep.

High temperature alkali corrosion has been known to cause premature failure of ceramic components used in advanced high temperature coal combustion systems such as coal gasification and clean-up, coal fired gas turbines, and high efficiency heat engines. The objective of this research is to systematically evaluate the alkali corrosion resistance of the most commonly used structural ceramics including silicon carbide, silicon nitride, cordierite, mullite, alumina, aluminum titanate, zirconia, and fireclay glass. The study consists of identification of the alkali reaction products (phase equilibria) and the kinetics of the alkali reactions as a function of temperature and time.

1042 (FRCEA-TH–367) **Modifications study of the electronic structure of silicon oxides (α-SiO_2), aluminium oxides (α-Al_2O_3) and yttrium oxides (Y_2O_3), induced by structural defects (non-stoichiometry, mechanical strains, high energy ions irradiation).** Jollet, F. CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Direction du Cycle du Combustible; Paris-6 Univ., 75 (France). Oct 1989. 176p. (In French). Order Number DE93720892. Source: OSTI; NTIS (US Sales Only); INIS.

Structure defects effects on electronic structure were studied experimentally (X absorption spectroscopy and photoelectron spectroscopy) and theoretically (state density calculus based on high binding strengths). This thesis is divided into three parts: oxygen stoichiometry effect on yttrium oxide (Y_2O_3) electronic structure, mechanical strain effect on quartz-α (SiO_2) electronic structure, high energy ions irradiation effects on quartz-α. (A.B.). refs., figs., tabs.

1043 (FRNC-TH–3720) **Study by X-ray diffraction of structure modifications induced by pressure in different actinide compounds: AnO_2 dioxides (An=Th, Pu, Am), $AnCl_4$ tetrachlorides (An=Th, U), UB_x borides (x=2,4,12) and the carbide UC_2.** Dancausse, J.P. Paris-11 Univ., 91 - Orsay (France). 16 Oct 1991. 257p. (In French). Order Number DE93721058. Source: OSTI; NTIS (US Sales Only); INIS.

Structural transitions, induced by pressure, of actinide compounds are studied by X-ray diffraction, the determination of incompressibility is also studied at atmospheric pressure. The crystal structure of ThO_2, PuO_2 and AmO_2 evolves, near 40 MPa from a fcc lattice to an orthorhombic lattice. Incompressibility values associated to UO_2 and NpO_2 incompressibility evidence an important discontinuity between UO_2 and NpO_2 and other dioxides due to their different electronic structure. Tetragonal $ThCl_4$ and UCl_4 undergo a structure transition respectively at 2 and 5 GPa. UCl_4 becomes monoclinic and its color changes. At higher pressure

these compounds become progressively amorphous. The crystal structure of uranium borides is not changed up to 50 GPa. UC_2 presents a phase transition at 17.6 GPa from a tetragonal to a hexagonal lattice.

1044 (INIS-BR–2933, pp. 216) **Analysis of PZT formation prepared by citrate organic solution.** Paiva-Santos, C.O. (UNESP, Presidente Prudente, SP (Brazil). Fac. de Ciencias e Tecnologia); Zaghette, M.A.; Varela, J.A.; Longo, E.; Mascarenhas, Y.P. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. PZT/calcination; CERAMICS; CITRATES; CRYSTAL STRUCTURE; ORGANIC SOLVENTS; PZT; CALCINATION; STOICHIOMETRY; TEMPERATURE RANGE 0400-1000 K

1045 (INIS-BR–2933, pp. 220) **Sintering of tungsten carbide using iron as binders.** Bedoya, R.N. (Rio Grande do Norte Univ., Natal, RN (Brazil)); Silva, A.G.P. da; Gomes, U.U. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. TUNGSTEN CARBIDES/sintering; BINDERS; IRON; MECHANICAL PROPERTIES; MICROSTRUCTURE; SINTERING

1046 (INIS-BR–2933, pp. 222) **Protection for crucibles of evaporation by electron gun.** Vasconcelos, G. de (Centro Tecnico Aeroespacial (CTA-IEAv), Sao Jose dos Campos, SP (Brazil). Inst. de Estudos Avancados); Damiao, A.J. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. ELECTRON GUNS/crucibles; ZIRCONIUM CARBIDES/electron guns; CRUCIBLES; EVAPORATION; GRAPHITE; SILICON CARBIDES; TEMPERATURE RANGE 1000-4000 K

1047 (INIS-BR–2933, pp. 224) **Studies on sintering and characterization of $Y_2Cu_2O_5$ and $BaCuO_2$ type ceramics.** Silva Machado, A.J. da (Fundacao de Tecnologia Industrial (FTI), Lorena, SP (Brazil). Centro de Materiais Refratarios); Andrade, A.J.P.; Rodrigues Junior, D.; Gomes, U.U. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. CERAMICS/sintering; CERAMICS; SINTERING; COPPER; LATTICE PARAMETERS; TEMPERATURE RANGE 0400-1000 K; TRANSPORT; YTTRIUM

1048 (INIS-BR–2933, pp. 223) **Quantitative determination of phases by x-ray diffraction.** Rodriges Junior, D. (Fundacao de Tecnologia Industrial (FTI), Lorena, SP (Brazil). Centro de Materiais Refratarios); Silva Machado, A.J. da. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. CERAMICS/phase diagrams; CALIBRATION; CERAMICS; LEAST SQUARE FIT; SUPERCONDUCTORS; X-RAY DIFFRACTION; ZIRCONIUM COMPOUNDS

1049 (INIS-BR–2933, pp. 215) **Characterization of piezoelectric ceramics.** Povoa, J.M. (Sao Carlos Univ., SP (Brazil). Dept. de Fisica); Rossi, J.C.; Medeiros, W.L.; Eiras, J.A. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. PZT/piezoelectricity; CERAMICS; FREQUENCY MEASUREMENT; PZT; PIEZOELECTRICITY; RESONANCE

1050 (INIS-BR–2933, pp. 224) **Potentiometric analysis for determining copper charge and oxygen content in Cu base oxides.** Alexandre, V. (Fundacao de Tecnologia Industrial (FTI), Lorena, SP (Brazil). Centro de Materiais Refratarios); Silva Machado, A.J. da; Jardim, R.F. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. BARIUM OXIDES/potentiometry; COPPER OXIDES/potentiometry; YTTRIUM OXIDES/potentiometry; POTENTIOMETRY; CHEMICAL COMPOSITION; SUPERCONDUCTORS; VALENCE; VOLUMETRIC ANALYSIS

1051 (INIS-BR–2933, pp. 269) **Electro-optical frequency modulators: fixed and variable frequency devices.** Monteiro, E.C. (Sao Paulo Univ., Sao Carlos, SP (Brazil). Inst. de Fisica e Quimica); Zilio, S.C.; Bagnato, V.S. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. CRYSTALS/frequency modulation; CAVITY RESONATORS; CRYSTALS; ELECTRO-OPTICAL EFFECTS; LITHIUM COMPOUNDS; NIOBATES; RF SYSTEMS; SPECTROSCOPY; TANTALATES

1052 (INIS-BR–2933, pp. 357) **Synthesis and characterization of $Y_1Ba_2Cu_3O_{7-x}$ using national raw materials.** Escanhoela, C.M.F. (Instituto de Pesquisas Energeticas e Nucleares (IPEN), Sao Paulo, SP (Brazil)); Leme, D.G.; Silva Queiroz, C.A. da; Morato, S.P. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. SAMPLE PREPARATION/oxides; SAMPLE PREPARATION/phase transformations; BARIUM; CALCINATION; COPPER; ELECTRIC CONDUCTIVITY; IMPURITIES; ION EXCHANGE CHROMATOGRAPHY; OXIDES; SINTERING; TEMPERATURE RANGE 0400-1000 K; X-RAY DIFFRACTION; YTTRIUM

1053 (INIS-BR–2933, pp. 355) **Measurements of electric quadrupole interaction in $In_2Cu_2O_5$, $InBa_2Cu_3O_x$ and $YBa_2Cu_3O_x$.** Saitovitch, H. (Centro Brasileiro de Pesquisas Fisicas (CBPF), Rio de Janeiro, RJ (Brazil)); Silva, P.R.J.; Weberszpil, J.; Rodriguez, A.M. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. CRYSTAL LATTICES/quadrupole moments; ANGULAR CORRELATION; BARIUM; COPPER OXIDES; INDIUM COMPLEXES; YTTRIUM

1054 (INIS-BR–2933, pp. 362) **Comparative analysis of mechanical stresses caused by H^+ and LI^+ intercalation in NiO_x films.** Scarminio, J. (Universidade Estadual de Londrina, PR (Brazil). Dept. de Fisica); Gorenstein, A.; Decker, F. Sociedade

Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355--: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. LITHIUM IONS/thin films; THIN FILMS/stresses; ELECTROCHEMICAL COATING; HYDROGEN IONS 1 PLUS; ION IMPLANTATION; NICKEL OXIDES; SPUTTERING; STRESSES

1055 (INIS-BR–2933, pp. 362) **Intercalation of electrochromic thin films of transition metal oxides.** Fonseca, C.M.P. da (Universidade Estadual de Campinas, SP (Brazil). Inst. de Fisica); Carvalho, C.R.; Torresi, R.M.; Torresi, S.C. de; Decker, F.; Gorenstein, A. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355--: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. THIN FILMS/optical properties; CLATHRATES; COBALT OXIDES; ELECTROCHEMICAL COATING; NICKEL OXIDES; SPECTROPHOTOMETRY; THERMAL GRAVIMETRIC ANALYSIS; TUNGSTEN OXIDES

1056 (INIS-BR–2933, pp. 343) **Specific heat of $YBa_2Cu_3O_{7-x}$ at low temperatures.** Garcia, S.C. (Universidade Federal, Rio de Janeiro, RJ (Brazil). Inst. de Fisica); Novak, M.A. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355--: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. CERAMICS/specific heat; BARIUM; CERAMICS; COPPER OXIDES; MAGNETIC FIELDS; OXIDATION; TEMPERATURE DEPENDENCE; YTTRIUM

1057 (INIS-BR–2933, pp. 343) **Resistive transition in deoxygenated YBaCuO.** Rodrigues Junior, P. (Rio Grande do Sul Univ., Porto Alegre, RS (Brazil). Inst. de Fisica); Pureur, P.; Schaf, J. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355--: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. HIGH-TC SUPERCONDUCTORS/electric conductivity; BARIUM OXIDES; COPPER OXIDES; CRITICAL TEMPERATURE; CURRENT DENSITY; POLYCRYSTALS; REDUCTION; TEMPERATURE DEPENDENCE; YTTRIUM OXIDES

1058 (INIS-BR–2933, pp. 344) **Pressure study of the electrical resistivity of high T_c superconductors.** Borges, H.A. (Pontificia Univ. Catolica do Rio de Janeiro, RJ (Brazil). Dept. de Fisica); Continentino, M.A. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (CONF-9105355--: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. HIGH-TC SUPERCONDUCTORS/electric conductivity; HIGH-TC SUPERCONDUCTORS/pressure dependence; BARIUM OXIDES; CERAMICS; COPPER OXIDES; CRITICAL TEMPERATURE; RARE EARTH COMPOUNDS

1059 (INIS-BR–2933, pp. 349) **Superconducting properties of $Ba_{1-x}K_xBiO_3$.** Lima, O.F. de (Universidade Estadual de Campinas, SP (Brazil). Inst. de Fisica); Torikachvili, M.S. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355--: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. HIGH-TC SUPERCONDUCTORS/magnetization; BARIUM OXIDES; BISMUTH OXIDES; CRITICAL TEMPERATURE; IRREVERSIBLE PROCESSES; MAGNETIC FIELDS; MAGNETOMETERS; POTASSIUM OXIDES; MAGNETIZATION; TEMPERATURE DEPENDENCE

1060 (INIS-BR–2933, pp. 352) **Magnetic properties of $YBa_2Cu_3O_{7-\delta}$ melt processed.** Tessier, L.R. (Centre des Materiaux Supraconducteurs, CRISMAT, Caen Cedx (France)); Wang, J.; Desgardin, G.; Maignan, A.; Provost, J.; Raveau, B. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355--: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. HIGH-TC SUPERCONDUCTORS/magnetization; ACTIVATION ENERGY; BARIUM OXIDES; COPPER OXIDES; CRITICAL CURRENT; MAGNETIC FIELDS; MELTING; SAMPLE PREPARATION; MAGNETIZATION; YTTRIUM OXIDES

1061 (INIS-BR–2933, pp. 352) **Resistivity and specific heat in YBaCuO-Ag samples.** Rodrigues, P. (Rio Grande do Sul Univ., Porto Alegre, RS (Brazil). Inst. de Fisica); Pureur, P.; Ghivelder, L.; Reich, S. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355--: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. CERAMICS/specific heat; BARIUM; CERAMICS; COPPER OXIDES; CRITICAL CURRENT; CRITICAL TEMPERATURE; ELECTRIC CONDUCTIVITY; SILVER; TEMPERATURE RANGE 0013-0065 K; TEMPERATURE RANGE 0065-0273 K; YTTRIUM

1062 (INIS-BR–2933, pp. 355) **Magnetic susceptibility, anisotropy and electrical resistivity in YBa_2Cu_3O, $Pb_2Sr_2(Y_{1.6}Ca_{0.2})Cu_3O_5$ and $Bi_2Sr_2CaCu_2O_5$ monocrystals.** Borges, H.A. (Pontificia Univ. Catolica do Rio de Janeiro, RJ (Brazil). Dept. de Fisica); Tholence, J.L.; Capponi, J.J. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355--: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. MONOCRYSTALS/magnetic susceptibility; ANISOTROPY; BARIUM; BISMUTH; CALCIUM; COPPER OXIDES; ELECTRIC CONDUCTIVITY; LEAD; MONOCRYSTALS; STRONTIUM; YTTRIUM

1063 (INIS-mf–13349, pp. 29) **Mono-crystal growth of high temperature HoBa2Cu3O7-x superconductor with four facet lattice symmetry.** Arabi, H. (Manchester Univ. (United Kingdom). Dept. of Physics). Iranian Physics Society, Teheran (Iran, Islamic Republic of). 1991. 53p. (In Persian). (CONF-9109417--: Iran's physics conference, Isfahan (Iran, Islamic Republic of), 10 Sep 1991). In *Abstract of articles from Iran's physics conference.* Order Number DE93000811. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. BARIUM OXIDES/crystal growth; COPPER OXIDES/crystal growth; HOLMIUM OXIDES/crystal growth; DIFFERENTIAL THERMAL ANALYSIS; HIGH-TC SUPERCONDUCTORS; MONOCRYSTALS; TETRAGONAL LATTICES; THERMAL GRAVIMETRIC ANALYSIS

1064 (IS-T–1571) **Rapid texturing of high temperature superconductors from amorphous precursors.** Arrasmith, S. Ames Lab., IA (United States). 9 Sep 1992. 82p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-82. Order Number DE93001217. Source: OSTI; NTIS; GPO Dep.

This study demonstrated that glass-ceramic processing (crystallization, sintering under uniaxial stress) in a uniaxial strain field can

rapidly produce well-textured Bi-2212 ($Bi_2Sr_2CaCu_2O_8$). This process is sensitive to oxygen partial pressure and oxygen content. The material textured by this process remains weak linked even at low temperature and low applied magnetic fields. Parameters that need to be optimized include composition, oxygen content, and processing. (DLC)

1065 (IS-T–1613) **Phase equilibria, superconductivity, and flux creep in $Nd_{1+x}Ba_{2-x}Cu_3O_{7+\delta}$ superconductors.** Yoo, Sang-Im. Ames Lab., IA (United States). 9 Sep 1992. 119p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-82. Order Number DE93001223. Source: OSTI; NTIS; GPO Dep.

$NdBa_2CU_3O_7$ (Ndl23) is one of $REBa_2CU_3O_7$ (RE123) superconductors (RE = Y and rare earths), having $T_c$of about 90 K. The phase diagram in the Nd-Ba-Cu-O system, superconductivity in Ndl23ss, and the role of Nd substitution for Ba sites as the magnetic flux pinning sites were investigated. The discrepancies in published phase diagrams were clarified. Significant results contain the solubility limits of $0.04 \leq x \leq 0.6$ in Ndl23ss, the existence of Nd_2BaCuO_{10} having a solid solution, and a discovery of a new phase $NdBa_6CU_3O_y$. Superconductivity in $Nd_{1+x}Ba_{2-x}CU_3O_{7+\delta}$ was studied for well- characterized samples with sharp transitions. With the substitution of Nd^{+3} for Ba^{+2}, there is an increase in the O(5) sites surrounding this substitution. While for $x > O.I$ there is a significant depression ofT_c, for $x < O.I$ there is no substantial decrease in $T_c$within experimental error. $T_c$vs x is characterized by two plateaus analogous to $T_c$vs d in $YBa_2CU_3O_{7-d}$. Analysis of O content of Ndl23ss suggests the analogy with Y123 is valid. Transition width and Meissner fraction for all Ndl23ss samples are strongly dependent on the sintering temperature. Hysteresis show good intragranular critical currents (J_c) at high fields but still low intergranular. Since the magnetic fields penetrate a Type II superconductor at high field, flux lines must be pinned to increase the J_c. While $T_c$is not affected over the range $0 < x < 0.1$, the oxygens surrounding the substituted Ba sites are expected to locally suppress the superconducting order parameter. Such a local suppression of the order parameter may act as a flux pinning site. Hysteresis exhibits a small increase in the magnetic J_c, but flux creep measurements show no apparent effects of this substitution on flux pinning energy.

1066 (JINR-E–17-91-159) **A dynamical model of structural phase transition in La_2CuO_4.** Plakida, N.M.; Krasavin, S.E. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Theoretical Physics. 1991. 10p. Order Number DE93605325. Source: OSTI; NTIS (US Sales Only); INIS.

A microscopical models of anharmonic lattice dynamics for $La_{2-x}M_xCuO_4$ crystals is proposed to describe the soft tilting mode and its interaction with strains. The free energy for the model is calculated and the structural phase transition $D_{4h}^{17} \rightarrow D_{2h}^{18} \rightarrow D_{4h}^{16}$ are considered. It is proposed a strong x-dependence of anharmonic constants especially for apical oxygen displacements. 18 refs.

1067 (Juel–2612) **Measurements for the production of aluminium oxide ceramics with defined microstructure parameters by using colloidal-chemical processings.** Baer, D.; Foerthmann, R.; Naoumidis, A.; Nickel, H. Forschungszentrum Juelich GmbH (Germany). Inst. fuer Reaktorwerkstoffe; Technische Hochschule Aachen (Germany). Apr 1992. 140p. (In German). Order Number DE93720326. Source: OSTI; NTIS (US Sales Only); INIS.

Doctoral thesis submitted by D. Baer.

The aim of this work is to verify the influences of the different single procedure steps on the microstructure of sintered alumina and to get a correlation between the product characteristics and the characteristic data. The powder production was carried out by using the sol-gel-process followed by freeze-drying of the gel. From the boehmit-powder porous and inhomogen microstructure of the sintered pellets was obtained. The unfavourable morphology of the hydroxide-powder could be eliminated by pre-calcination followed by powder-milling. Because of the wet-milling after the pre-calcination the powder was doped with α-Al_2O_3, caused by the abrasion of the milling-mug and -balls, and therefore the calcinating temperature could be reduced to 1050deg C. Two charges of the colloidal-chemical produced powder and four commercial powders with different characteristics with regard to the purity or doping and particle-size and -distribution were compared with themselves. These powders were cold-isostatically pressed and sintered under different conditions. It could be shown that the influence of the impurities on the microstructure is higher than the influence of the grain size distribution. Impurities lead to a discontinous grain size distribution and intracristalline pores in sintered bodies, even using powders with a small grain size distribution. Measurements on the slip casted samples yielded for all powders different relationships between the viscosity and the pH. There was no visible influence of different pH-values on the microstructure (pH always measured at the minimum of the viscosity). Here the influence of the purity and the grain size distribution on the microstructure was less pronounced compared with the isostatically pressed ceramics. (orig.).

1068 (KAERI/RR–1096/91) **The development of SiC whisker fabrication technology for nuclear applications.** Kang, Thae Khapp (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Kuk, Il Hiun; Kim, Whung Whoe; Paik, Hae Seung; Im, Kyung Soo; Oh, Seok Jin. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Feb 1992. 152p. (In Korean). Order Number DE93605320. Source: OSTI; NTIS (US Sales Only); INIS.

A new silicothermic process for making SiC whisker was studied. By heating for 1 hour at 1,500 deg C SiO_2-Si compact showed 71.56% weight loss. Such a reduction in weight attributed to the high reactivity of the compact. When SiO_2-Si compact was covered by coarse ceramic granule layer, SiC whiskers were formed on surface of the ceramic granules. This new method is named a peach process. Among various C-containing source gases, hydrocarbon gases, such as methane, exhibited active whisker growth. Development of a new metallic composite reinforced with SiC whiskers was tried using zircaloy. (Author).

1069 (LA-UR–92-3003) **Ceramics models in the MESA codes.** Mandell, D.A.; Henninger, R. Los Alamos National Lab., NM (United States). [1992]. 24p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-921162–9: Hypervelocity impact symposium, Austin, TX (United States), 17-20 Nov 1992). Order Number DE93000683. Source: OSTI; NTIS (US Sales Only); GPO Dep.

We have implemented two ceramics models into the MESA Eulerian finite difference hydrocodes and evaluated them by comparing code predictions of the free surface velocity as a function of time to data for one-dimensional flyer plate impacts and to free surface velocity data for the penetration of subscale tungsten rods into ceramic plates. Results were obtained for silicon carbide, boron carbide, alumina, alumina, titanium diboride, and for a base calculation using a steel plate.

1070 (LA-UR–92-3022) **NQR study of local structures and cooling rate dependent superconductivity in $La_2CuO_{4+\delta}$.** Reyes, A.P. (Los Alamos National Lab., NM (United States)); Ahrens, E.T.; Hammel, P.C.; Heffner, R.H.; Thompson, J.D.; Canfield, P.C.; Fisk, Z.; Schirber, J.E. Los Alamos National Lab., NM (United States). [1992]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-921201–2: 36. conference on magnetism and magnetic materials, Houston, TX (United States), 1-4 Dec 1992). Order Number DE93000680. Source: OSTI; NTIS; GPO Dep.

Structural properties of oxygen-annealed polycrystals of $La_2CuO_{4+\delta}$ ($\delta \sim 0.03$) have been studied using ^{139}La NQR spectroscopy. Superconducting critical temperatures were found to depend on the rate of cooling through a narrow temperature range at about 195K. Preliminary analysis of the ^{139}La NQR spectra suggest that the oxygen-rich phase-separated region is composed of two structurally distinct phases, both of which are metallic and super-conducting. One phase has a structure closely related to the stoichiometric oxygen-poor compound. The second shows a considerable amount of apical oxygen disorder, a large shift in NQR frequency ν_Q, and a volume fraction which increases with cooling rate. The formation of the second phase below –200K is indicative of the freezing Of CuO_6 octahedral tilting. Abrupt shifts in ν_Q above $T_c$were also observed for both phases, suggestive of a local structural anomaly or charge transfer to the Cu-O plane.

1071 (LA-UR–92-3069) **Transport and magnetization critical current densities in $TlBa_2Ca_2Cu_3O_x$ tapes.** Willis, J.O.; Maley, M.P.; Kung, P.J.; Coulter, J.Y.; Peterson, D.E.; Wahlbeck, P.G.; Bingert, J.F.; Phillips, D.S. Los Alamos National Lab., NM (United States). [1992]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-920802–17: Applied superconductivity conference, Chicago, IL (United States), 23-28 Aug 1992). Order Number DE93000651. Source: OSTI; NTIS; INIS; GPO Dep.

The powder in tube process was used to produce silver-sheathed tapes of $TlBa_2Ca_2Cu_3O_{8+x}$ (Tl-1223). The powder was produced by thalliating a precursor powder mixture to produce the Tl-2223 phase and then beating to drive off excess Tl and reach the Tl-1223 stoichiometry. The tapes were rolled and pressed, each step followed with a 3 h sintering. The 200 μm thick tapes show little sign of texturing; however, the critical current shows a small (~50%) dependence on the direction of the applied magnetic field. Both transport and magnetization measurents indicate relatively strong pinning at high temperatures. The 75 K self field critical current density is 62 MA/m^2. Transport measurements reveal the presence of weak links at all temperatures, but with a relatively weak field dependence above ≈0.1T.

1072 (LA-UR–92-3086) **Summary of phase separation, structure and superconductivity in super-oxygenated $La_2CuO_{4+\delta}$.** Hammel, P.C.; Ahrens, E.T.; Reyes, A.P.; Thompson, J.D.; Fisk, Z.; Canfield, P.C.; Schirber, J.E. Los Alamos National Lab., NM (United States). [1992]. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-9205236–4: Conference on phase separation in cuprate superconductors, Sicily (Italy), 6-12 May 1992). Order Number DE93000855. Source: OSTI; NTIS; INIS; GPO Dep.

We report the measurements of the excess content in oxygen-annealed $La_2CuO_{4+\delta}$. Below the phase separation temperature, TpS, Several features of the phase diagram for this material are unusual. The oxygen content changes discontinuously in both the oxygen-poor and oxygen-rich phases. Below this temperature, these change very little. We propose that the phase separation temperature is determined by the excess content of the oxygen-poor (antiferromagnetic) phase which in turn determines the Neel temperature. Phase separation occurs when the resulting sublattice magnetization is approximately 1/2 the zero temperature value. Bulk magnetization measurements show that the superconducting $T_c$is dependent on the cooling rate in a narrow temperature range well separated from TpS. This and nuclear quadrupole resonance (NQR) provide evidence for the role of temperature dependent structural changes in this effect. The possible role of such changes in determining the normal state properties and the superconductivity is discussed.

1073 (LA-UR–92-3188) **Magnetic hysteresis and flux creep of $YBa_2Cu_3O_x$ grown by the melt-powder-melt-growth (MPMG) process.** Kung, P.J. (Los Alamos National Lab., NM (United States)); McHenry, M.E.; Maley, M.P.; Willis, J.O.; Murakami, M.; Tanaka, S. Los Alamos National Lab., NM (United States). 24 Aug 1992. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-920802–19: Applied superconductivity conference, Chicago, IL (United States), 23-28 Aug 1992). Order Number DE93000870. Source: OSTI; NTIS; GPO Dep.

Magnetic hysteresis and flux creep of melt-powder-melt-growth (MPMG) $YBa_2Cu_3O_x$ containing nominal 0, 25 and 40 mole% Y_2BaCuO_5 (21 1) were measured in the temperature range of 5 to 80 K and in magnetic fields up to 5 T. With the introduced fine dispersion of second phase 211 particles, the critical magnetization current density J_c shows a weak field dependence over a wide range of temperature, and the effective pinning energy U_{eff} is much enhanced. From these results, a functional expression $U_{eff}(J,T) = -U_o\, G(T)\, (J\,|J_i)^n$ is obtained, where $G(T) = [1 - (T|T_x)^2]^2$ with Tx = 82.5 K near the irreversibility temperature. The observed power-law relationship of $U_{eff}(J, T)$ clearly demonstrates two of three regimes as predicted by the theory of collective flux creep, namely n = 3/2 and 7/9 for $J < J_c$ and $J \ll J_c$, respectively. In addition, the divergence of U_{eff} at low current densities also suggests the existence of a vortex-glass state.

1074 (LBL–32258) **Crystalline growth of wurtzite GaN on (111) GaAs.** Ross, J. (California Univ., Berkeley, CA (United States). Dept. of Electrical Engineering and Computer Sciences); Gustafson, T.K.; Rubin, M. Lawrence Berkeley Lab., CA (United States). Dec 1991. 6p. Sponsored by USDOE, Washington, DC (United States); National Science Foundation, Washington, DC (United States). DOE Contract AC03-76SF00098. Contract 1-442427-21482. (CONF-911202–85: Annual fall meeting of the Materials Research Society, Boston, MA (United States), 2-6 Dec 1991). Order Number DE92041165. Source: OSTI; NTIS; GPO Dep.

Gallium Nitride films were grown on (111) gallium arsenide substrates using reactive rf magnetron sputtering. Despite a 20% lattice mismatch and different crystal structure, wurtzite. Heteroepitaxy was observed for growth temperatures between 550-600°C. X-ray diffraction patterns revealed (0002) GaN peak with a full-width-half-maximum (FWHM) as narrow as 0.17°. Possible surface reconstructions to explain the epitaxial growth are presented.

1075 (LBL–32510) **Temperature history and microstructure of alumina.** Lin, Jiang Tsair. Lawrence Berkeley Lab., CA (United States). May 1992. 116p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. Order Number DE92041196. Source: OSTI; NTIS; GPO Dep.

A simple process for the attainment of fully dense and improved microstructure for Al_2O_3 ceramics has been developed. Pure, narrow size distribution, submicron powder is used. Homogenization heat treatment of Al_2O_3 powder compacts at 800°C for 50 hours produces more uniform pore structure and higher green strength. Pore size distribution becomes narrower. Near fully dense, fine-grained (< 1.2μm) and uniform grain size-distribution, undoped Al_2O_3 ceramics can be produced using a high quality powder, a high-pressure cold isostatic forming method, and a two-step sintering technique. Improvements in the microstructure of Al_2O_3 ceramics homogenized at 800°C/50 h include a smaller pore size and a more uniform pore size distribution. Prevention of differential densification in the early stages and delay of pore channel closure to the later stages of sintering are believed to be the primary mechanisms for the microstructure improvement in two-step sintering. Two-step sintering is an alternate way to improve the microstructure of Al_2O_3 ceramics compared to fast firing or MgO doping. When a homogenization heat treatment and the fast firing are combined, the final density is higher than from fast firing alone. However, the two-step sintering technique is simple and there is no size limit. Generalization of two-step sintering to more systems is needed. For 250 ppM MgO-doped Al_2O_3 ceramics, homogenization of powder compacts at 800°C for 50 hours produces 0.80μm. This improvement is explained by the distribution of MgO becoming more uniform during the homogenization heat treatment, which enhances the effectiveness of MgO doping.

1076 (LBL–32513) **Simulation of vortex-line pinning by defects in the Y-Ba-Cu-O system.** Jamison, R. (Lawrence Berkeley Lab., CA (United States)); Burmester, C.P.; Gronsky, R.; Wille, L.T. Lawrence Berkeley Lab., CA (United States). Mar 1992. 6p. Sponsored by USDOE, Washington, DC (United States); Department of Defense, Washington, DC (United States); Postal Service, Washington, DC (United States). DOE Contract AC03-76SF00098. Grant MDA972-88-J-1002. (CONF-920402–59: Material Research Society spring meeting, San Francisco, CA (United States), 27 Apr - 2 may 1992). Order Number DE92041185. Source: OSTI; NTIS; GPO Dep.

The temperature properties of a two-dimensional flux lattice are studied by Monte Carlo simulation, with particular attention to the effects of twin-boundaries. The parameters selected are appropriate for the $YBa_2CU_30_7$ high-temperature superconducting system. The intrinsic properties of the vortex state are investigated by monitoring system evolution at fixed temperature and applied magnetic field. By varying the temperature, the loss of type-II superconductivity via fluxoid lattice melting is also examined. The introduction of model defects induces the creation of metastable and glassy states which reduce overall hexane order but are found to enhance system resistance to flux-lattice melting.

1077 (LBL–32689) **Interaction in polysilazane/SiC powder systems.** Boiteux, Y.P. Lawrence Berkeley Lab., CA (United

States). Jul 1992. 121p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. Order Number DE92041178. Source: OSTI; NTIS; GPO Dep.

Consolidation of ceramic precursor ceramic powder systems upon heating is investigated. A polysilazane (silicon nitride precursor) is chosen as ceramic precursor with a filler of a sub-micron SiC powder. A scheme to optimize the volume fraction of precursor is developed in order to maximize the density of the compacted samples in the green state. Different techniques are presented to improve the homogeneity of precursor distribution in the mixture. A microencapsulation technique is developed that leads to a uniform coating of precursor on individual SiC particles. Upon pyrolysis of systems with 20 wt% polysilazane, little shrinkage occurs. The SiC particles do not coarsen during the heat treatment. The precursor, upon pyrolysis, transforms into an amorphous ceramic phase that acts as a cement between SiC particles. This cement phase can remain amorphous up to 1500°C; and is best described as a siliconoxycarbide with or without traces of nitrogen. Elimination of nitrogen in the amorphous phase indicates that the filler material (SiC) has a strong influence on the pyrolysis behavior of the chosen polysilazane. The amorphous ceramic phase may crystallize between 1400 and 1500°C, and depending on the nature of the gas environment, the crystalline phases are SiC, Si or Si_3N_4. Mechanisms explaining the strength increase upon heat treatment are proposed. Redistribution of the precursor occurs by capillary forces or vapor phase diffusion and recondensation of volatile monomers. The confined pyrolysis of the precursor results in an increase of residual ceramic matter being decomposed inside the sample. Interfacial reaction between the native silica-rich surface layer on SiC particles and the precursor derived phase explains the high strength of the materials.

1078 (SAND–92-1878C) **Energy distribution of trapped holes in irradiated SiO_2.** Fleetwood, D.M.; Miller, S.L. Sandia National Labs., Albuquerque, NM (United States). [1992]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-921226–2: 1992 Institute of Electrical and Electronic Engineers (IEEE) semiconductor interface specialists conference, San Diego, CA (United States), 9-13 Dec 1992). Order Number DE92040979. Source: OSTI; NTIS; GPO Dep.

There is a discrepancy between literature estimates of trapped-hole energies in irradiated SiO_2 obtained via thermal and optical methods (0.6-1.4 eV and 3 eV, respectively). A method has been developed for obtaining an improved estimate of the energy distribution of trapped holes in irradiated SiO_2, which brings thermal and optical estimates into much closer agreement. Experimental and theoretical TSC (thermally stimulated current) spectra are shown for a soft MOS capacitor with a 350-nm oxide cycled through 4 irradiations (10 keV x rays) and TSC measurements. Four trap-energy distributions were also independently derived from TSC at different ramp rates for a 45-nm radiation-hardened oxide. The trap distributions inferred from TSC for the 45-nm hard oxide agree with each other and with that inferred for the soft 350-nm oxide. 2 figs, 8 refs. (DLC)

3606 Other Materials

Refer also to citation(s) 106, 107, 235, 237, 244, 262, 729, 730, 737, 742, 835, 836, 1043, 1158, 1160, 1175, 1231, 1265, 1272, 1675, 2090, 2386

1079 (CEA-CONF–10989) **Early phyllosilicates formed by alteration of R7T7 glass in water at 250 deg C.** Vernaz, E. (CEA Centre d'Etudes de la Vallee du Rhone, 30 - Marcoule (France). Dept. des Procedes de Retraitement); Dussossoy, J.L.; Caurel, J.; Crovisier, J.L. CEA Centre d'Etudes de la Vallee du Rhone, 30 - Marcoule (France). Dept. des Procedes de Retraitement. 1991. 16p. (CONF-911123–: 15. international symposium on the scientific basis for nuclear waste management, Strasbourg (France), 5-8 Nov 1991). Order Number DE93720911. Source: OSTI; NTIS (US Sales Only); INIS.

T7T7 glass samples have been altered during periods of one and seven days at 250 deg C in distilled water. Ultramicrotomic thin sections were performed in the outermost part of the glass for a study under analytical transmission electron microscope. After one day the alteration layer is about 5 μm thick. It is made up of sheeted silicated particles, tentatively identified as septechlorite (7 A intervals) mixed with an intercrystalline amorphous matrix of different composition. After seven days the alteration layer is about 11 μm thick. It is made up of sheeted silicated particles of smectite type (10 A intervals). No 7 A particles were found in the seven days sample. This study illustrates the capacity of poorly crystalline phyllosilicates to adapt to the chemical changes in solution. 15 refs., 4 tabs., 2 plates.

1080 (CEA-CONF–10990) **Experimental alteration of R7T7 glass in salt brines at 90 deg C and 150 deg C.** Godon, N. (CEA Centre d'Etudes de la Vallee du Rhone, 30 - Marcoule (France). Dept. des Procedes de Retraitement); Vernaz, E.; Gin, S.; Beaufort, D.; Thomassin, J.H. CEA Centre d'Etudes de la Vallee du Rhone, 30 - Marcoule (France). Dept. des Procedes de Retraitement. 1991. 15p. (CONF-911123–: 15. international symposium on the scientific basis for nuclear waste management, Strasbourg (France), 5-8 Nov 1991). Order Number DE93720912. Source: OSTI; NTIS (US Sales Only); INIS.

Static experiments have been developed to investigate the R7T7 glass corrosion in four natural salt brines (brines 1 and 3: pure halite, brines 2 and 4: high Mg, K fluid inclusions rich halite), at 90 deg C and 150 deg C with 0.7 cm^{-1} S/V ratio and at 11 different running times. Analysis of brines after alteration (pHmeter and ICP) added to a detailed study of the crystalline phases developed at the interface glass-brine (XRD,SEM and Microprobe), showed that the influence of the compositional difference is more important on the nature of the secondary phases formed than on the corrosion rate of the glass. After 91 days of alteration at 150 deg C stady states to be reached (after 40 days at 90 deg C). A long term experiment (1 year) is necessary to confirm this hypothesis. 7 refs., 7 figs., 2 tabs.

1081 (CEA-CONF–10991) **Effect of surface finish on nuclear glass dissolution rate.** Dussossoy, J.L. (CEA Centre d'Etudes de la Vallee du Rhone, 30 - Marcoule (France). Dept. des Procedes de Retraitement); Vernaz, E.; Dubois, C.; Chambaudet, A. CEA Centre d'Etudes de la Vallee du Rhone, 30 - Marcoule (France). Dept. des Procedes de Retraitement. 1991. 7p. (CONF-911123–: 15. international symposium on the scientific basis for nuclear waste management, Strasbourg (France), 5-8 Nov 1991). Order Number DE93720913. Source: OSTI; NTIS (US Sales Only); INIS.

The influence of the surface finish on nuclear glass dissolution was investigated. Seven different surface finishes were tested: a specimen as cut four specimens polished to grades 220, 600, 4000 and 1 μm, a flame-polished specimen and a thermal rupture specimen. The initial glass corrosion rates were measured after 7 and 28 days of Soxhlet leaching at 100 deg C. The surface finish of each glass coupon was also assessed by three-dimensional analysis before and after leaching for 28 days. Leaching solution analyses showed that the mean apparent leach rate for the first 7 days was highly dependent on the surface finish: the measured rates ranged from 3.8 $g.m^{-2}d^{-1}$ for the as-cut specimen to 1.3 $g.m^{-2}d^{-1}$ for the flame-polished specimen. The differences in the leach rates diminished considerably after 28 days of leaching: the mean rate measured between 7 and 28 days for the as-cut and polished specimens was identical (1.7 $g.m^{-2}d^{-1}$), but was still lower for the remaining two specimens. Three-dimensional surface analysis showed that leaching revealed surface defects (superficial microcracks) produced by cutting or polishing. These effects were less perceptible on the flame-polished or thermally ruptured specimens. The actual surface area of the cut and polished specimens exceeded the apparent geometrical area. In another experiment, the leach rates measured for as-cut specimens and flame-polished specimens were measured over periods of five months or more using a thermogravity balance placed above the Soxhlet device. The experiment confirmed the existence of an initial period during which the dissolution rate for the as-cut specimen was much higher than the mean corrosion rate. 4 refs., 3 figs., 2 tabs.

1082 (CEA-CONF–10992) **Effect of platinoids on French LWR reference glass properties.** Pacaud, F.; Fillet, C.; Jacquet-Francillon, N. CEA Centre d'Etudes de la Vallee du Rhone, 30 - Marcoule (France). Dept. des Procedes de Retraitement. 1991. 7p.

(CONF-911123–: 15. international symposium on the scientific basis for nuclear waste management, Strasbourg (France), 5-8 Nov 1991). Order Number DE93720914. Source: OSTI; NTIS (US Sales Only); INIS.

Nine samples of the 'R7T7' glass composition selected to vitrify fission product solutions in France were prepared with added platinoid elements (ruthenium, rhodium and palladium) in soluble form and as insoluble metal particles in solution, and their major properties were measured. Regardless of the initial form when added to the glass the platinoids always formed the same heterogeneous inclusions in the final glass: RuO_2 precipitates which were often found as aggregates, and polymetallic (Pd, Rh and Te) inclusions. The particles tended to settle in the molten glass. The viscosity increased by about 20% at 1100 deg C. The mechanical properties and short-term leach rates were not significantly affected. Crystallization increased by a factor of 2 or 3 in heat-treated glass specimens but did not exceed a few volume percent. However, as the short-term leach rate did not significantly increase, the glass properties were very satisfactory.

1083 (CEA-CONF–10993) **R7T7 glass alteration in the presence of mortar: effect of the cement grade.** Andriambololona, Z.; Godon, N.; Vernaz, E. CEA Centre d'Etudes de la Vallee du Rhone, 30 - Marcoule (France). Dept. des Procedes de Retraitement. 1991. 8p. (CONF-911123–: 15. international symposium on the scientific basis for nuclear waste management, Strasbourg (France), 5-8 Nov 1991). Order Number DE93720915. Source: OSTI; NTIS (US Sales Only); INIS.

R7T7 glass alteration was investigated in the presence of four mortars prepared from four different cement grades: 'CPA' Portland cement (mortar M1), CPA with pozzolana additive (M2), CPA with amorphous silica additive (M3) and 'CLK' blast furnace slag cement (M4). Glass specimens were also altered in Volvic mineral water and in a cement effluent. Glass corrosion in the cement media was greater than in Volvic water, but well below what could be expected from the high pH (approx 12.5). The relatively low alteration was probably related to the protective action of the calcium-enriched gel layer that formed at the glass surface. The glass corrosion rate was 2 to 3 times lower with cement containing pozzolana or silica gel additives or with CLK cement than with CPA cement alone. 8 refs., 8 figs.

1084 (CEA-CONF–11028) **Electric field dependent paramagnetic defect creation in single step implanted Simox films.** Leray, J.L. (CEA Centre d'Etudes de Bruyeres-le-Chatel, 91 (France)); Margail, J.; Devine, R.A.B. CEA Centre d'Etudes de Bruyeres-le-Chatel, 91 (France). 1991. 12p. (CONF-911109–: Fall meeting of the European Materials Research Society, Strasbourg (France), 5-8 Nov 1991). Order Number DE93721148. Source: OSTI; NTIS (US Sales Only); INIS.

X irradiation induced oxygen-vacancy defect creation has been studied in SIMOX produced by single step implantation and annealing. It is shown that SIMOX is substantially more radiation sensitive (for these defects) than thermal or bulk oxide. Irradiation in the presence of an electric field 0.5 - 1 MV cm^{-1} is found to enhance the rate of defect creation by $\geq$ 2 times. Further enhanced defect creation is observed in SIMOX samples whose substrate has been chemically thinned prior to irradiation. This enhancement is attributed to modification of the network induced by hydrogen introduced during the thinning process.

1085 (CONF-9208129–3) **Combined small-angle neutron and x-ray scattering studies of polymers.** Wignall, G.D. Oak Ridge National Lab., TN (United States). [1992]. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 41. annual Denver x-ray conference; Denver, CO (United States); Aug 1992. Order Number DE93000440. Source: OSTI; NTIS; GPO Dep.

Over the past two decades, small-angle neutron scattering (SANS), using cold neutrons (4-20 Å), has proven to be an important tool for the evaluation of polymer chain conformation. Due to a fortuitous combination of several factors (penetrating power, deuteration, solvent choice), SANS has developed into a very powerful tool for the study of polymers. This article focuses on the information provided by SANS and demonstrates how it has complemented and expanded upon the data available from other scattering techniques (e.g., SAXS). Applications to homogenous polymer mixtures, phase-separated polymer blends, and carbon-filled polymers are discussed. 34 refs, 18 figs, 2 tabs. (DLC)

1086 (CONF-9209207–1) **Unsolved problems of crystallization and melting of flexible macromolecules: Attempts at the understanding of the molecular process by experiments and computer simulation.** Wunderlich, B. (Tennessee Univ., Knoxville, TN (United States). Dept. of Chemistry). Oak Ridge National Lab., TN (United States). [1992]. 12p. Sponsored by USDOE, Washington, DC (United States); National Science Foundation, Washington, DC (United States). DOE Contract AC05-84OR21400. Grant DMR 92-00520. From NATO workshop on crystallization of polymers; Mons (Belgium); 6-12 Sep 1992. Order Number DE92040876. Source: OSTI; NTIS; INIS; GPO Dep.

The thermodynamics, kinetics, and computer simulations of crystallization and melting is discussed. The thermodynamics is shown to be well understood, although for many specific crystals not enough details for full description are available. Experiments on the crystallization kinetics of poly(ethylene) and poly(oxyethylene) in the presence of crystal nuclei as a function of molecular mass revealed that with increasing mass, the crystallization behavior deviates increasingly from that of small, rigid molecules. Instead of showing a continuously changing, linear crystallization rate with temperature through the equilibrium melting temperature, T_m^0, these flexible macromolecules show a region of practically zero crystallization rate between T_m^0 and about (T_m^0 - 15) K, creating a temperature region of metastability in the melt that cannot be broken by nucleation with pregrown crystals. Molecular Nucleation was proposed as a cooperative process to be of overriding importance for the description of polymer crystallization, and to be at the center of segregation of molecules of lower molecular mass by growing crystal fronts. Initial efforts to model sufficiently large crystals using Monte Carlo and molecular dynamics methods are presented. Some of the short-time intermediates in the melting, crystallization, and annealing processes seem to have little similarity to commonly assumed models of crystallization and melting and are presented as discussion topics.

1087 (DOE/CE/23810–3B) **Chemical and thermal stability of refrigerant-lubricant mixtures with metals: Quarterly report, 1 April 1992–30 June 1992.** Huttenlocher, D.F. Spauschus Associates, Inc., Atlanta, GA (United States). 10 Jul 1992. 63p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-91CE23810. Order Number DE93000537. Source: OSTI; NTIS; GPO Dep.

This report presents completed sealed tube stability test results for the following eight refrigerant/lubricant mixtures: R-22/mineral oil; R-124/alkylbenzene; R-134a/pentaerythritol (PE) ester (mixed acid); R- 134a/PE (branched acid); R-134a/PE (100 cSt viscosity); R- 142b/alkylbenzene; R-143a/PE (branched acid); R-152a/alkylbenzene. Partial results are shown for an additional eight refrigerant-lubricant mixtures. Though work is in progress, no data are available at this point in time for the five remaining test mixtures. Reported are: visual observations on aged sealed tubes, gas chromatographic analyses on the vapor phase contents of the tubes, chloride ion contents of HCFC containing mixtures or fluoride ion contents of HFC mixtures, and total acid number values and infrared analysis results for mixtures containing ester lubricants.

1088 (DOE/CE/23810–3C) **Miscibility of lubricants with refrigerants: Quarterly report, 1 April 1992–30 June 1992.** Pate, M.B.; Zoz, S.C.; Berkenbosch, L.J. Iowa State Univ. of Science and Technology, Ames, IA (United States). Dept. of Mechanical Engineering. Jul 1992. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-91CE23810. Order Number DE93000538. Source: OSTI; NTIS; GPO Dep.

Miscibility data is being obtained for a variety of non-CFC refrigerants and their potential lubricants. Ten different refrigerants and seven different lubricants are being investigated. Experiments are being performed in two phases: Phase I focuses on performing screening tests and Phase II consists of developing miscibility plots. The miscibility tests are being performed in a test facility consisting of a series of miniature test cells submerged in a constant temperature bath. The bath temperature can be precisely controlled over a temperature range of -50°C to 100°C. The test

cells are constructed to allow for complete visibility of lubricant-refrigerant mixtures under all test conditions. Early in this reporting period, new procedures for charging the lubricant and refrigerant into the cells for testing were adopted. All of the refrigerants and all but one of the lubricants have been received from the manufacturers. Data obtained to date includes that for R-134a, R142b, R-32, R-134, R-125, and R-143a with four lubricants, namely, two esters and two polypropylene glycols.

1089 (DOE/CE/23810–3D) **Compatibility of refrigerants and lubricants with motor materials: Quarterly technical progress report, April 1, 1992–June 30, 1992.** Doerr, R.; Kujak, S. Trane Co., La Crosse, WI (United States). 23 Jul 1992. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-91CE23810. Order Number DE93000540. Source: OSTI; NTIS; GPO Dep.

During this last quarter, evaluations were complete on the motor materials after 500-hr exposures to refrigerants CFC-123, HFC-134a and HCFC-22 at 90°C. Materials were also evaluated after exposure to nitrogen at 127°C to determine effect of the thermal exposure. Other exposures were started during this quarter with refrigerants HCFC-124, HFC-125, HFC-143a, HFC-32 and HFC-152a. One 500 hr exposure is set up per week and one is analyzed the same week. This will enable Trane to complete the 500 hour exposures by the end of the year.

1090 (DOE/CE/23810–3E) **Compatibility of refrigerants and lubricants with elastomers: Quarterly report, 1 April 1992–30 June 1992.** Hamed, G.R.; Seiple, R.H. Akron Univ., OH (United States). Inst. of Polymer Science. Jul 1992. 236p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-91CE23810. Order Number DE93000539. Source: OSTI; NTIS; GPO Dep.

Information contained in this reporters designed to assist the air-conditioning and refrigeration industry in the selection of suitable elastomeric gasket and seal materials that will prove useful in various refrigerant and refrigeration lubricant environments. Swell measurements have been made on approximately 50% of the proposed elastomers (94 total)in both the lubricant (7 total) and refrigerant (10 total) materials. Swell behavior in the these fluids have been determined using weight and in situ diameter measurements for the refrigerants and weight. diameter and thickness measurements for the lubricants. Weight and diameter measurements are repeated after 2 hours and 24 hours for samples removed from the refrigerant test fluids and 24 hours after removal from the lubricants.

1091 (DOE/CE/23810–3F) **Compatibility of refrigerants and lubricants with engineering plastics: Quarterly report, 1 April 1992–30 June 1992.** Cavestri, R.C. Imagination Resources, Inc., Dublin, OH (United States). Jul 1992. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-91CE23810. Order Number DE93000541. Source: OSTI; NTIS; GPO Dep.

All seven oil immersion studies are complete at both temperatures. Nine out of ten refrigerant ambient immersion studies are complete including 60C (140F) for R-123. All 22 plastic test materials have been molded into test bars. All test bars have been quality controlled for physical consistency and integrity. All 22 test chambers are functional. Creep loads have been increased to 25% of ultimate tensile. Refrigerant has solubilities of Emery 2927 with R-22 and 134a are complete.

1092 (DOE/CH/10204–T1) **Localized excitations in amorphous silicon alloys: Final report.** Morehouse Coll., Atlanta, GA (United States). Oct 1987. 34p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-84CH10204. Order Number DE93001790. Source: OSTI; NTIS; GPO Dep.

The valence band edge of a-Si:H is sensitive to H content, while the conduction band edge is not. The optical gap increases 50% going from the isolated SiH group to the polysilane configuration; the smallest energy gap was for the polycrystal models for a-Si:H. Only the complexes involving the Si dangling bond give rise to active states deep in he a-Si fundamental energy gap. Positions of dangling bond defect state agree with photoluminescence of undoped and oxidized a-Si:H films. Incorporation of halogens into a-Si:H increases the optical gap, quasi-localized states near conduction band tail, and resonances deep in the valence band. Carbon increases the optical gap and produces resonances deep in both bands, while tin does not increase the optical gap and produces resonances in upper part of a-Si:H valence band; this is consistent with a model based on relative strength of Si-Si bond to Si-impurity bond. Effects of P dopant are consistent with models based on P in a-Si:H producing dopant-defect pairs, increased Fermi energy, etc. B substitutional dopants (tetrahedral) produces states near the valence band edge which resemble the show impurity levels in crystalline Si. Trigonally bonded B gives rise to states within the a-Si:H fundamental gap. B-H complexes suggest B-H bonds in B-doped a-Si:H, even at low B contents. Figs, 22 refs. (DLC)

1093 (DOE/ER/13433–4) **Thermal plasma processing of materials: Progress report, September 1, 1988–January 31, 1992.** Pfender, E.; Heberlein, J. Minnesota Univ., Minneapolis, MN (United States). Dept. of Mechanical Engineering. Feb 1992. 33p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-85ER13433. Order Number DE93003118. Source: OSTI; NTIS; GPO Dep.

Emphasis has been on plasma synthesis of fine powders, plasma Chemical Vapor Deposition (CVD), on related diagnostics, and on modeling work. Since plasma synthesis as well as plasma CVD make frequent use of plasma jets, the beginning has been devoted of plasma jets and behavior of particulates injected into such plasma jets. Although most of the construction of the Triple-Torch Plasma Reactor (TTPR) has already been done, modifications have been made in particular modifications required for plasma CVD of diamond. A new reactor designed for Counter-Flow Liquid Injection Plasma Synthesis (CFLIPS) proved to be an excellent tool for synthesis of fine powders as well as for plasma CVD. An attempt was made to model flow and temperature fields in this reactor. Substantial efforts were made to single out those parameters which govern particle size, size distribution, and powder quality in our plasma synthesis experiments. This knowledge is crucial for controlling the process and for meaningful diagnostics and modeling work. Plasma CVD of diamond films using both reactors has been very successful and we have been approached by a number of companies interested in using this technology for coating of tools.

1094 (DOE/ER/45314–5) **Plasma, photon, and beam synthesis of diamond films and multilayered structures: Progress report, July 1, 1990–September 1992.** Chang, R.P.H. Northwestern Univ., Evanston, IL (United States). Dept. of Materials Science and Engineering. Sep 1992. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-87ER45314. Order Number DE93001749. Source: OSTI; NTIS; GPO Dep.

In the area of nucleation, it was discovered that C_{70} thin films are perfect substitutes for diamond seeds in the growth of diamond films. This research, along with a careful study of diamond growth on carbon ion implanted single crystal copper, have clearly demonstrated that structured carbon is the best precursor for nucleation and growth of diamond films on non-diamond surfaces. In addition, by using fluorine chemistry during diamond growth, it has been shown that diamond films can grow on carbide substrates without the pretreatment of diamond seeding. The growth rates are higher and the film adhesion is much improved.

1095 (DOE/ER/45419–3) **Role of structure in ion movement of glasses: Progress report, January 5, 1992–November 1, 1992.** Jain, H. Lehigh Univ., Bethlehem, PA (United States). 3 Nov 1992. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-90ER45419. Order Number DE93001844. Source: OSTI; NTIS; GPO Dep.

Three kinds of experiments were performed: modified random network model and ion movement; role of melt structure in ion transport in glassy state; and ion movement in fluorozirconate glass (breakdown of correspondence between electrical and nuclear spin relaxation). A comment is offered on dielectric loss peak in glasses. 11 refs, 1 fig. (DLC)

1096 (DOE/ID/12692–3) **Dual cure solventless coating process: Phase 3, Semiannual technical report, October 1, 1991–March 1992.** Minnesota Mining and Mfg. Co., St. Paul, MN

(United States). Corporate Research Labs. Oct 1992. 47p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-88ID12692. Order Number DE93001352. Source: OSTI; NTIS; GPO Dep.

The objective of Phase III of 3M's contract with the US Department of Energy is to complete proof-of-principle testing in full-scale systems of the dual cure photocatalyst technology developed in earlier Phases of the program. The Phase III commercial applications to be demonstrated are aerospace topcoats, aerospace primers, and solventless manufacture of tape backings. Work has been initiated in all three applications. Significant progress has been made in improving the performance of the urethane/acrylate formulation being used for the aerospace topcoat application. Key improvements have been made in obtaining reliable coating cure and increasing reverse impact and gloss performance. A subcontract has been initiated with Boeing Defense and Space Group to perform testing of candidate 3M topcoat formulations in accordance with various military and commercial specifications. Technical challenges are being encountered with the aerospace primer formulation. Efforts to date have focused on establishing a good baseline epoxy/acrylate formulation with reliable cure conditions. Work on the third demonstration application, development of solventless backing saturants for electrical tape backings, has progressed well. Since the start of the program, evaluation of various backing substrates has been completed, initial resin formulations developed and optimized, and preparation of samples of complete tape constructions using dual cure backings.

1097 (FRCEA-TH–368) **Methods for the preparation of ultra-pure anhydrous zirconium tetrafluoride from zirconium tetraborohydride, researches in connection with halide glasses.** Tortevois, R. CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Direction des Sciences de la Matiere; Paris-6 Univ., 75 (France). 15 Mar 1990. 173p. (In French). Order Number DE93721140. Source: OSTI; NTIS (US Sales Only); INIS.

The synthesis of ultrapure zirconium tetrafluoride, the main component of fluorozirconate based optical fibers, was successfully attempted from zirconium tetraborohydride. Of the fluorinating agents used, nitrogen trifluoride doesn't react with zirconium tetraborohydride while xenon difluoride reacts too violently and leads to phases which contain boron. The fluorination in a compatible solvent enabled us to minimize the degradation. The best results were obtained with the fluorination of $Zr(BH_4)_4$ dissolved in $CFCl_3$ at -40 deg C by anhydrous HF. Using several analytical methods such as graphite furnace atomic absorption and proton activation, we analyzed the purity. The degree of transition element impurities is less than the ppm level for ZrF_4. The dehydration of ZrF_4,H_2O and $ZrF_4,3H_2O$ at room temperature by ClF_3 in gaseous and liquid state was also investigated. At exceptionally low temperature, this process allows oxide and oxyfluoride components to be reduced.

1098 (IC–92/197) **Melting and liquid structure of polyvalent metal halides.** Tosi, M.P. International Centre for Theoretical Physics, Trieste (Italy). Aug 1992. 25p. Order Number DE93605371. Source: OSTI; NTIS (US Sales Only); INIS.

A short review is given of recent progress in determining and understanding liquid structure types and melting mechanisms for halides of polyvalent metals. The nature of the preferred local coordination for the polyvalent metal ion in the melt can usually be ascertained from data on liquid mixtures with halogen-donating alkali halides. The stability of these local coordination states and the connectivity that arises between them in the approach to the pure melt determines the character of its short-range and possible medium-range order. A broad classification of structural and melting behaviours can be given on the basis of measured melting parameters and transport coefficients for many compounds, in combination with the available diffraction data on the liquid structure of several compounds. Correlations have been shown to exist with a simple indicator of the nature of the chemical bond and also with appropriate parameters of ionic models, wherever the latter are usefully applicable for semiquantitative calculations of liquid structure. Consequences on the mechanisms for valence electron localization in solutions of metallic elements into strongly structured molten salts are also briefly discussed. (author). 46 refs, 4 figs, 2 tabs.

1099 (INIS-BR–2933, pp. 215) **Phase transformations in lithium and rubidium sulfate.** Camargo, F. (Universidade Estadual de Campinas, SP (Brazil). Inst. de Fisica); Lemos, V.; Hernandes, A.C. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. LITHIUM SULFATES/phase transformations; RUBIDIUM SULFATES/phase transformations; DEFORMATION; RAMAN SPECTRA

1100 (INIS-BR–2933, pp. 294) **Electronic structure of polyacetylene with bonded oxygen.** Lavarda, F.C. (Universidade Estadual de Campinas, SP (Brazil). Inst. de Fisica); Galvao, D.S.; Laks, B. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. DECOMPOSITION/nuclear magnetic resonance; ELECTRONIC STRUCTURE/nuclear magnetic resonance; CARBON 13; DECOMPOSITION; HYDROCARBONS; OXYGEN

1101 (INIS-BR–2933, pp. 291) **Study on transport properties in latex doped with iodine.** Silva, M.D. (Instituto de Pesquisas Espaciais (INPE), Sao Jose dos Campos, SP (Brazil)); Leite, N.F.; Miranda, L.C.M. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. LATEX/crystal doping; LATEX/iodine; ATOM TRANSPORT; DIELECTRIC PROPERTIES; LATEX; IODINE; OPTICAL PROPERTIES; THERMODYNAMIC PROPERTIES

1102 (INIS-BR–2933, pp. 284) **Conductivity induced by ionizing radiation in polymer films.** Cunha, H.N. da (Sao Paulo Univ., Sao Carlos, SP (Brazil). Inst. de Fisica e Quimica); Faria, R.M. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. POLYMERS/ionic conductivity; POLYMERS/physical radiation effects; POLYMERS; THIN FILMS

1103 (INIS-BR–2933, pp. 294) **Study on thermal behaviour of poly(chloro sulfonate ethylene).** Andrade, L.A. (Sao Paulo Univ., SP (Brazil). Inst. de Fisica); Amaral, L.Q.; Fernandes, E.G. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. POLYMERS/radiation effects; POLYMERS/thermal degradation; AMORPHOUS STATE; ELECTRON BEAMS; IRRADIATION; POLYMERS; THERMAL GRAVIMETRIC ANALYSIS; X-RAY DIFFRACTION

1104 (INIS-BR–2933, pp. 367) **Characterization of carbon allotropic shapes obtained by CVD ferrous substrates.** Hinrichs, R. (Rio Grande do Sul Univ., Porto Alegre, RS (Brazil). Inst. de Fisica); Fritzen, C.L.; Oliveira, L.S. de; Silva, M.T.X.; Livi, R.P.; Jornada, J.A.H. da. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on*

Condensed Matter Physics. v.2. Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. CARBON/chemical vapor deposition; CARBON/films; ALLOTROPY; CARBON; FILMS; HYDROGEN; IRON COMPOUNDS; MOESSBAUER EFFECT; SCANNING ELECTRON MICROSCOPY; SUBSTRATES; X-RAY DIFFRACTION

1105 (INIS-BR–2933, pp. 368) **Formation of spatial charge and modification of composition in glasses submitted to external DDP.** Lepiesnki, C.M. (Centro de Pesquisas de Energia Eletrica, Rio de Janeiro, RJ (Brazil)); Achete, C.A.; Freire Junior, F.L.; Giacometti, J.A. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. GLASS/electric fields; GLASS/fabrication; BEAM INJECTION; GLASS; FABRICATION; HYDROGEN IONS; NUCLEAR REACTIONS; QUANTITY RATIO; RUTHERFORD SCATTERING; SODIUM

1106 (INIS-BR–2933, pp. 368) **Direct photoelectrochemical etching of microstructure onto InP.** Soltz, D. (Universidade Estadual de Campinas, SP (Brazil)); Decker, F.; Cascato, L. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. INDIUM PHOSPHIDES/etching; DIFFRACTION GRATINGS; ETCHING; MICROSTRUCTURE; SURFACES

1107 (INIS-BR–2933, pp. 380) **Influence of deposition conditions on Si:H-a films obtained by cathodic pulverization.** Ramos, A. (Universidade Estadual de Campinas, SP (Brazil). Inst. de Fisica); Gualberto, G.M.; Mammana, A.P. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. HYDROGEN/deposition; ACTIVATION ENERGY; AMORPHOUS STATE; CRUSHING; CRYSTAL DEFECTS; ELECTRIC CONDUCTIVITY; FILMS; HYDROGEN; DEPOSITION; INFRARED SPECTRA; PRESSURE DEPENDENCE; REFRACTIVITY; SILICON; SPUTTERING; TEMPERATURE DEPENDENCE

1108 (INIS-BR–2933, pp. 311) **Optical studies on strained heterostructures of $In_xGa_{1-x}As/GaAs$ and $In_xGa_{1-x}As/GaAs/Al_yGa_{1-y}As$.** Lima, W.L.C. (Sao Paulo Univ., Sao Carlos, SP (Brazil). Inst. de Fisica e Quimica); Motisuke, P.; Sacilotti, M.A. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. ALUMINIUM ARSENIDES/photoluminescence; GALLIUM ARSENIDES/photoluminescence; INDIUM ARSENIDES/photoluminescence; PHOTOLUMINESCENCE; BAND THEORY; CHEMICAL VAPOR DEPOSITION; MICROSTRUCTURE; HETEROJUNCTIONS

1109 (INIS-BR–2933, pp. 338) **Kinetic of free carriers in semiconductors II-VI highly excited by picosecond lasers.** Cruz, J.M.R. (Brasilia Univ., DF (Brazil). Dept. de Fisica); Driel, H.M. van. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. CADMIUM SELENIDES/carrier mobility; CARRIER DENSITY; CRYSTAL LATTICES; KINETICS; LASER RADIATION; OPTICAL PROPERTIES; SEMICONDUCTOR MATERIALS

1110 (INIS-mf–13349, pp. 30) **Interface formation between rare earths surface and silicon, and it's characteristics.** Gokhale, Sh.; Aazam Khoosravi, A. Iranian Physics Society, Teheran (Iran, Islamic Republic of). 1991. 53p. (In Persian). (CONF-9109417–: Iran's physics conference, Isfahan (Iran, Islamic Republic of), 10 Sep 1991). In *Abstract of articles from Iran's physics conference.* Order Number DE93000811. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. RARE EARTHS/interfaces; SILICON/interfaces; DYSPROSIUM SILICIDES; ELECTRIC CONDUCTIVITY; MEDIUM VACUUM; PRECIPITATION; INTERFACES; SILICON; THULIUM SILICIDES

1111 (IS-T–1585) **Spin dependent recombination in conjugated polymers: An optically detected magnetic resonance study.** Swanson, L.S. Ames Lab., IA (United States). 9 Sep 1992. 126p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-82. Order Number DE93001221. Source: OSTI; NTIS; INIS; GPO Dep.

This work describes and discusses Photoluminescence (PL), and X-band Photoluminescence Detected Magnetic Resonance (PLDMR) of poly(3-alkylthiophene) (P3AT) films and solutions, poly(para-phenylenevinylene) (PPV), poly(2,5-dihexoxyparaphenylenevinylene) (PDHOPV), poly(2,5-dioctoxyparaphenylenevinylene) (PDOOPV), blends of poly(2-methoxy,5-(2'ethylhexoxy)paraphenylenevinylene) (PMOE-HOPV) with polyethylene (PE) films both unoriented and oriented, and poly(2,5-dibutoxyparaphenyleneacetylene) (PDBOPA) films. The Electroluminescence Detected Magnetic Resonance (ELDMR) and Conductivity Detected Magnetic Resonance (CDMR) narrow quenching signal in PPV is also reported and discussed.

1112 (IVO-B–01/92) **Measurement of reinforcement corrosion in concrete structures.** Meuronen, A. Imatran Voima Oy (IVO), Helsinki (Finland). Mar 1992. 22p. (In Finnish). Order Number DE93711155. Source: OSTI; NTIS.

Ageing and aggressive enviromental conditions of concrete structures will result in deterioration of concrete and corrosion of steel in concrete. Corrosion of steel will in time result in the end of the service life or expensive renovations, unless corrosion of steel is noticed and renovated in time. Corrosion of steel in concrete can be found out by the present corrosion measurement methods, so that renovation can be started in right time. The report presents mainly on the basis of the literature references the following corrosion measurement methods: polarisation resistance, AC-impedance, electrical resistance probe, electrochemical noice and half-cell potential mapping. The half-cell potential mapping will be presented more precisely than the other corrosion measurement methods, for the potential mapping is the most used method. Concrete and Soils Laboratory of Imatran Voima Oy uses in the measurement of reinforcement corrosion the English, eight channel potential measuring equipment.

1113 (IVO-B–02/92) **Chloride corrosion of reinforcement and cathodic protection.** Meuronen, A.; Westerlund, E. Imatran Voima Oy (IVO), Helsinki (Finland). Mar 1992. 45p. (In Finnish). Order Number DE93711154. Source: OSTI; NTIS.

Chloride corrosion of steel in concrete may result in shortening of the service life or a premature, expensive renovation or even failure of the renovation, unless the factors of chloride corrosion are known. It is nowadays impossible to remove chlorides from concrete reliably without cutting out chloride contamined concrete layer. However, after the renovation concrete may often contain chlorides so much that corrosion of steel will start and the service life will shorten. The expected service life can be gained by renovating the structure so both the threshold value of chloride content (the value after corrosion starts) and speed of the corrosion process are taken into account in the plans. The other renovating method is cathodic protection to stop corrosion. In the beginning of the report,

chloride corrosion of steel in concrete (not in cold climate) is given on the base of the literature references and experience of renovations. Influence of binding material of concrete to threshold value and to continuation of corrosion process are presented. The proposal to the binding material quality and the minimum content of binding material are given. The end of the report presents the prerequisites to cathodic protection and designing principles.

1114 (JINR-R–11-91-371) **Finite element method for simulation of the semiconductor devices.** Zikatanov, L.T.; Kaschiev, M.S. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Computing Techniques and Automation. 1991. 12p. (In Russian). Order Number DE93605379. Source: OSTI; NTIS (US Sales Only); INIS.

An iterative method for solving the system of nonlinear equations of the drift-diffusion representation for the simulation of the semiconductor devices is worked out. The Petrov-Galerkin method is taken for the discretization of these equations using the bilinear finite elements. It is shown that the numerical scheme is a monotonous one and there are no oscillations of the solutions in the region of p-n transition. The numerical calculations of the simulation of one semiconductor device are presented. 13 refs.; 3 figs.

1115 (Juel–2606) **Microstructure of porous silicon. Optical and electron-spectroscopic investigations.** Muender, H. Forschungszentrum Juelich GmbH (Germany). Inst. fuer Schicht- und Ionentechnik; Technische Hochschule Aachen (Germany). Apr 1992. 134p. (In German). Order Number DE93720396. Source: OSTI; NTIS (US Sales Only).

Semiconductor materials were characterized by Raman spectroscopy IR spectroscopy, ellipsometry, LEED, AES, XPS, UPS and TER. The materials analyzed were GaAs/Si(100) heteroepitactic layers and porons si films. In view of the fact that doping of the substrate will affect the microescopic structure of the perons Si layers, both p-doped and p$^+$-doped materials were analyzed. Porosities varied between 36% and 75%. Further, also the effect of pre-oxidation in the physical properties of the porons strata was investigated. (orig./MM).

1116 (LBL–32388) **Optical characterization of sputtered carbon films.** Ager, J.W. III. Lawrence Berkeley Lab., CA (United States). May 1992. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-9207153–1: Institute of Electrical and Electronic Engineers (IEEE) magnetic recording conference, Santa Clara, CA (United States), 21-23 Jul 1992). Order Number DE92041209. Source: OSTI; NTIS; GPO Dep.

Spattered carbon films are widely used as protective overcoats for thin film disk media. Raman spectroscopy is nondestructive and relatively rapid and is well suited for the characterization of carbon films. Specific features in the Raman spectra are empirically correlated with the rates of specific types of mechanical wear for both hydrogenated and unhydrogenated films. This observation is interpreted in terms of a random covalent network, in which the mechanical performance of the film is determined by the nature of the bonding that links sp^2-bonded domains.

1117 (LBL–32642) **The processing and potential applications of porous silicon.** Syyuan Shieh. Lawrence Berkeley Lab., CA (United States). Jul 1992. 144p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. Order Number DE92041195. Source: OSTI; NTIS; GPO Dep.

Stability of a cylindrical pore under the influence of surface energy is important for porous silicon (PS) processing in the integrated circuit industry. Once the zig-zag cylindrical pores of porous silicon or oxidized porous silicon (OPS) are unstable and breakup into rows of isolated spherical pores, oxidation of PS and densification/nitridation of OPS become difficult. Swing to difficulty transport of reactant gas (O_2, NH_3) or the trapped gas (for densification of OPS). A first order analysis of the stability of a cylindrical pore or cylinder is considered first. Growth of small sinusoidal perturbations by viscous flow or evaporation/condensation result in dependence of perturbation growth rate on perturbation wavelength. Rapid thermal oxidation (RTO) of porous silicon is proposed as an alternative for the tedious two-step 300 and 800C oxidation process. Transmission electron microscopy, energy dispersive spectroscopy ESCA are used for quality control. Also, rapid thermal nitridation of oxidized porous silicon in ammonia is proposed to enhance OPS resistance to HF solution. Pores breakup of OPS results in a trapped gas problem during densification. Wet helium is proposed as OPS densification ambient gas to shorten densification time. Finally, PS is proposed to be an extrinsic gettering center in silicon wafers. The suppression of oxidation-induced stacking faults is used to demonstrate the gettering ability. Possible mechanism is discussed.

1118 (ORNL/Sub–85-55901/03) **Modeling of forced flow/thermal gradient chemical vapor infiltration.** Starr, T.L. (Oak Ridge National Lab., TN (United States)); Smith, A.W. Oak Ridge National Lab., TN (United States); Georgia Tech Research Inst., Atlanta, GA (United States). Sep 1992. 37p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93001615. Source: OSTI; NTIS; GPO Dep.

The forced flow/thermal gradient chemical vapor infiltration process (FCVI) has proven to be a successful technique for fabrication of ceramic matrix composites. It is particularly attractive for thick components which cannot be fabricated using the conventional, isothermal method (ICVI). Although it offers processing times that are at least an order of magnitude shorter than ICVI, FCVI has not been used to fabricate parts of complex geometry and is perceived by some to be unsuitable for such components. The major concern is that selection and control of the flow pattern and thermal profile for optimum infiltration can be a difficult and costly exercise. In order to reduce this effort, we are developing a computer model for FCVI that simulates the densification process for given component geometry, reactor configuration and operating parameters. Used by a process engineer, this model can dramatically reduce the experimental effort needed to obtain uniform densification. A one-dimensional process model, described in a previous interim report, has demonstrated good agreement with experimental results in predicting overall densification time and density uniformity during processing and the effect of various fiber architectures and operating parameters on these process issues. This model is fundamentally unsuitable for more complex geometries, however, and extension to two- and three-dimensions is necessary. This interim report summarizes our progress since the previous interim report toward development of a "finite volume" model for FCVI.

1119 (SAND–92-0392C) **Strained quantum well modulation-doped InGaSb/AlGaSb structures grown by molecular beam epitaxy.** Klem, J.F. (Sandia National Labs., Albuquerque, NM (United States)); Lott, J.A.; Schirber, J.E.; Kurtz, S.R.; Lin, S.Y. Sandia National Labs., Albuquerque, NM (United States). [1992]. 14p. Sponsored by USDOE, Washington, DC (United States); Department of Defense, Washington, DC (United States). DOE Contract AC04-76DP00789. Grant 88-0248. (CONF-920676–2: Electronic materials conference, Cambridge, MA (United States), 24-26 Jun 1992). Order Number DE93000755. Source: OSTI; NTIS; GPO Dep.

Strained single quantum well InGaSb/AlGaSb structures for field-effect transistor applications have been grown by molecular beam epitaxy. Modulation-doped p-type structures have been characterized by a variety of techniques, including Hall effect, Shubnikov-de Haas measurements, and cyclotron resonance. These structures exhibit improved hole transport in comparison to similar GaSb/AlGaSb structures as a result of strain-splitting of the valence band. P-channel field-effect transistors fabricated in this system exhibited a maximum transconductance of 51 and 161 ms/mm at 300 and 77K, respectively, for a 1.2μm gate-length device.

1120 (SAND–92-1813C) **Application of grazing incidence x-ray diffraction to polymer blends.** Goehner, R.P. (General Electric Co., Schenectady, NY (United States). Research and Development Center); Garbauskas, M.F.; LeGrand, D.G. Sandia National Labs., Albuquerque, NM (United States). [1992]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-9208129–4: 41. annual Denver x-ray conference, Denver, CO (United States), Aug 1992). Order Number DE93000709. Source: OSTI; NTIS; GPO Dep.

The physical properties of polymer blends consisting of one or more crystallizable components are affected by the microstructure of these materials. In particular, the degree of crystallinity can be

influenced by processing parameters, and the crystallinity, as well as the phase distribution, may vary as a function of depth through an injection molded part Conventional x-ray diffraction techniques can provide information regarding both phase composition and degree of crystallinity, but, because of the relative transparency of these materials to wavelengths generally available in the laboratory, these techniques provide information representative of only the bulk. By employing parallel beam optics at varying grazing incidence angles, the x-ray sampling depth can be varied without loss of resolution. This technique can be used to vary the effective analysis depth from the top several hundred angstroms for low razing incidence to centimeters for transmission diffraction patterns. Grazing incidence techniques have found initial application in the characterization of thin metallic and ceramic films. This paper demonstrates the feasibility of using parallel beam to depth profile low atomic number materials. The specific application of this optics technique to the characterization of injection molded polymers, including a blend of bisphenol-A polycarbonate (PC) and polybutylene terephthalate (PBT), will be presented.

1121 (STRIPA-TR–91-33) **Cement based grouts - longevity laboratory studies: leaching behaviour.** Onofrei, M. (AECL-Research, Pinawa, Manitoba (Canada). Whiteshell Laboratories); Gray, M.; Roe, L. Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden). Dec 1991. 95p. Order Number DE93603538. Source: OSTI; NTIS; INIS.

This report describes a series of laboratory tests carried out to determine the possible leaching behaviour of cement-based grouts in repository environments. A reference high-performance cement-based grout, comprised of Canadian Type 50 (U.S. Type V) Sulphate Resisting Portland Cement, silica fume, potable water and superplasticizer, and a commercially available cement grout were subjected to leaching in distilled water and three simulated groundwaters of different ionic strength. Hardened, monolithic specimens of the grout were leached in static, pulsed-flow and continuous flow conditions at temperatures from 10 degrees C to 150 degrees C for periods of up to 56 days. The changes in concentration of ions in the leachants with time were determined and the changes in the morphology of the surfaces of the grout specimens were examined using electron microscopy. After a review of possible mechanisms of degradation of cement-based materials, the data from these experiments are presented. The data show that the grouts will leach when in contact with water through dissolution of more soluble phases. Comparison of the leaching performance of the two grouts indicates that, while there are some minor differences, they behaved quite similarly. The rate of the leaching processes were found to tend to decrease with time and to be accompanied by precipitation and/or growth of an assemblage of secondary alteration phases (i.e., $CaCO_3$, $Mg(OH)_2$). The mechanisms of leaching depended on the environmental conditions of temperature, groundwater composition and water flow rate. Matrix dissolution occurred. However, in many of the tests leaching was shown to be limited by the precipitated/reaction layers which acted as protective surface coatings. (37 refs.) (au).

1122 (UCRL-JC–110665) **Matrix-dominated mechanical properties of a fiber composite lamina.** Lyon, R.E.; Schumann, D.L.; DeTeresa, S.J. Lawrence Livermore National Lab., CA (United States). 18 May 1992. 24p. Sponsored by USDOE, Washington, DC (United States); Department of Defense, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9205232–1: 11. American Society for Testing and Materials (ASTM) symposium on composite materials: testing and design, Pittsburgh, PA (United States), 4-5 May 1992). Order Number DE93001320. Source: OSTI; NTIS; GPO Dep.

Matrix-dominated mechanical properties of unidirectional fiber composite laminae were determined from hoop-wound tube specimens and cylindrical rods fabricated from both wet-filament winding and prepreg material systems. Longitudinal shear modulus and strength as well as transverse Young's modulus, transverse tensile strength, and transverse compressive strength were obtained from a thin-walled tube specimen using a new fixturing design. Lamina properties are presented for several carbon fiber/epoxy composite materials. Longitudinal shear moduli were measured for both tubes and rods in torsion. Results obtained in the linear-elastic regimes above and below the glass transition temperature (Tg) of the matrix phase were compared with micromechanics predictions. Although agreement between predicted and measured shear moduli was reasonable below Tg, large discrepancies were observed when the matrix phase was elastomeric.

1123 (UCRL-JC–111033) **Comments on transformational superplasticity: an example from a non-metal, ammonium nitrate.** Meike, A.; McLaren, A.C. Lawrence Berkeley Lab., CA (United States). Jul 1992. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-920670–5: 6. international conference on intergranular and interphase boundaries in materials, Thessaloniki (Greece), 22-26 Jun 1992). Order Number DE93001315. Source: OSTI; NTIS; GPO Dep.

Two complementary compressive creep experiments have been used to investigate potential transformation superplastic effects in polycrystalline ammonium nitrate (NH_4NO_3): a micro- deformation apparatus for in-situ observation during deformation under an optical microscope, and a bulk specimen creep apparatus for temperature gradient experiments. Results indicate that more than one experimental effect has been interpreted in the past as transformation superplasticity. We have isolated three effects that produce "anomalous weakening" that can be associated with both displacive and reconstructive transformations may operate. These multiple and possibly interdependent mechanisms suggests that transformation superplasticity operates according to a more complex constitutive flow law than has been recognized in the past.

1124 (Y/EN–4124-Rev.1) **Procedure and analysis reports in support of the hollow clay tile wall testing program: Revision 1.** Oak Ridge Y-12 Plant, TN (United States); Tennessee Univ., Knoxville, TN (United States). Nov 1990. 127p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OS21400. Order Number DE92041224. Source: OSTI; NTIS; GPO Dep.

The following are included that were generated in the research program on the structural behavior of clay tile walls: test procedure for out-of-plane full scale static testing of a hollow clay tile wall panel, ultimate strength calculations for out-of-plane air bag tests, test procedure for in-plane infilled frame static testing of a hollow clay tile wall panel, in-plane infilled frame static testing of a hollow clay tile wall panel (calculations), test procedure for in-plane masonry static testing of a hollow clay tile wall panel, numerical analysis for in-plane behavior of infilled frames, in-plane analysis of hollow clay tile infilled frames (effect of wall-frame interface and connection rigidity), test procedure for in-plane masonry biaxial compressiont esting of a hollow clay tile wall panel, and outbuilding test program. (DLC)

1125 (Y/EN–4536/V1) **Structural testing of hollow clay tile units: Volume 1.** Flanagan, R.D. (Oak Ridge Y-12 Plant, TN (United States)); Bennett, R.M. Oak Ridge Y-12 Plant, TN (United States). 5 Aug 1992. 46p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OS21400. (CNPE/HCT–12). Order Number DE92041270. Source: OSTI; NTIS; GPO Dep.

This report presents the results of laboratory testing of hollow clay tile masonry units. The testing is part of an ongoing natural phenomena evaluation program of Hollow Clay Tile Wall (HCTW) facilities at the Oak Ridge Y-12 Plant. The primary purpose of these tests is to determine structural properties of unit tiles of the same lot to be used in large-scale laboratory testing of HCTW structures. Light red (terra cotta) clay masonry units, taken from the construction supply yard of were sampled and tested in accordance with applicable ASTM standards. Measurement of size, measurement of void area, initial rate of absorption, compressive strength, and splitting tensile strength procedures were performed. Evaluation of the test results along with comparison to other published clay tile data is provided. Volume 1 of this document contains a description of the testing, a summary of the results, comparison to other published clay tile data, and conclusion drawn from the results. Volume 2 contains the unreduced test data, data reduction software, and quality assurance aspects of the testing.

1126 (Y/EN–4595) **Test procedure for prism compression testing of laboratory built prisms: Hollow clay tile wall testing**

program. Fricke, K.E.; Butala, M.B. Oak Ridge Y-12 Plant, TN (United States). Apr 1992. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OS21400. (HCTP–04L). Order Number DE92041223. Source: OSTI; NTIS; GPO Dep.

This procedure describes the fabrication and testing of hollow clay tile (HCT) prisms under laboratory conditions. Objective of the HCT prism compression tests is to determine the compressive strength, Modulus of Elasticity, and Poissons's ratio of the HCT walls as they exist in the Y-12 plant walls. Load versus displacement behavior, including the maximum load and post-peak deformation characteristics will be obtained. The prism test is the standard test used to determine values for f'_m (specified compressive strength at 28 days) which are then used to obtain Code design allowable values. Reason for using laboratory built prisms is that it is a cumbersome process to remove prism specimens from existing walls, transport them to the test site, and then load them into a testing fixture. The wall prisms would be quite fragile as they come out of the walls, and thus the use of laboratory built prisms will permit the testing of more specimens under better controlled conditions.

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Refer also to citation(s) 760

1127 (UCRL–53943-91) **Chemistry and Materials Science, 1990–1991: [Second annual report].** Sugihara, T.T.; Bruner, J.M.; McElroy, L.A. (eds.). Lawrence Livermore National Lab., CA (United States). [1991]. 241p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE93001761. Source: OSTI; NTIS; GPO Dep.

This 2-year (FY 1990-91) contains 49 technical articles in ten sections: research sampler, metals and alloys, energetic materials, chemistry and physics of advanced materials, bonding and reactions at surfaces and interfaces, superconductivity, energy R and D, waste processing and management, characterization and analysis, and facilities and instrumentation. Two more sections list department personnel, their publications etc., consultants, and summary of department budgets. The articles are processed separately for the data base. (DLC)

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Refer also to citation(s) 25, 28, 134, 138, 184, 187, 188, 189, 192, 222, 275, 1153, 1571, 1665, 1668, 2146, 2426, 2427

1128 (BARC–1992/E/003) **Laser based analytical spectroscopy of uranium.** Argekar, A.A. (Bhabha Atomic Research Centre, Bombay (India). Radiochemistry Div.); Kulkarni, M.J.; Godbole, S.V.; Page, A.G.; Samuel, J.K.; Paranjape, D.B.; Singh Mudher, K.D. Bhabha Atomic Research Centre, Bombay (India). 1992. 25p. Order Number DE93605122. Source: OSTI; NTIS (US Sales Only); INIS.

Analytical spectroscopy of uranium has been studied using a XeCl excimer laser, using the fluorescence emission of U(VI) ions doped in a solid solution of sodium fluoride (NaF) and sodium chloride (NaCl) in 3:2 proportion. An electronic circuitry involving time-gating of the photomultiplier tube and facility to integrate the analytical signal over ten laser pulses has been developed to enable laser operation and signal detection with high S/N ratio. The matrix enhanced U(VI) fluorescence emission is free from chemical and spectral interferences due to the concomitant presence of ten metallic elements generally associated with uranium. The digital signal output is highly precise and does not saturate upto 5 ppm uranium concentration. X-ray diffraction patterns obtained for uranium doped compounds at 2.5% and 10% dopant concentrations are broadly similar to that of $Na_2U_2O_7$. The detailed studies have, however, revealed fine structure for individual peaks, thereby, revealing the formation of sodium fluoro-uranate complex which is responsible for the enhanced intensity of fluorescence emission. (author). 10 refs., 6 figs., 2 tabs.

1129 (DOE/ER/13572–1) **The effect of electric fields upon liquid extraction: Progress report.** Carleson, T.E. Idaho Univ., Moscow, ID (United States). Dept. of Chemical Engineering. 13 Apr 1988. 26p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG07-86ER13572. Order Number DE92040894. Source: OSTI; NTIS; GPO Dep.

A series of mass transfer studies were conducted for the extraction of solute from droplets falling in an electric field. The experiments were planned such that the dispersed phase resistance was controlling. In one series of experiments single drops were formed from a charged nozzle and allowed to fall through a continuous, dielectric phase. The drop size and velocity were correlated by means of a simple force balance. Drop mass transfer coefficients were calculated for the drop free fall period and were compared to predictions based upon literature correlations for an oscillating droplet in-the absence of an electric field. Droplet size and velocity were approximately predicted by a staple force balance whereas the mass transfer coefficient was approximately 25–250% higher than that predicted. Droplet extraction efficiencies increased about 20–30% in the presence of electric fields up to 2 kv/cm. For the same field, the drop diameter decreased 30–50% and the terminal velocity increased by up to 50%. The enhancements for the toluene-water system can be ascribed to increases in terminal velocity and decreases in drop diameter. The mass transfer model for freely falling drops proposed by Skelland and Wellek roughly predicts the moderate mass transfer efficiency increases (about 18% at 1 kv/cm) for the toluene water system but failed to predict the increases (about 25% at 0.5 kv/cm) for the heptane furfural system. The second series of experiments involved the formation of a swarm of droplets in a three stage sieve tray column. In a separate series of experiments. the effect of the electric field upon mass transfer from drops exhibiting interfacial turbulence was evaluated.

1130 (DOE/ER/13572–4) **Drop oscillation and mass transfer in alternating electric fields: Progress report.** Carleson, T.E.; Yang, W. Idaho Univ., Moscow, ID (United States). Dept. of Chemical Engineering. 30 May 1991. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG07-86ER13572. Order Number DE92040897. Source: OSTI; NTIS; GPO Dep.

After the second annual progress report to DOE in July 1990, we continued the experimental work for another liquid system. The mathematical model was also improved to include secondary effects due to drop deformation and charge redistribution on the deformed drop surface. Originally, we planned to study a mass transfer process after the hydrodynamic modelling. Due to difficulty in measuring drop concentration during oscillations, we decided to study a heat transfer process instead. Using the analogy between the mass transfer and the heat transfer, we can easily extend the results for the heat transfer study to the mass transfer problem.

1131 (DOE/ER/13613–36) **Capillary liquid chromatography using laser-based and mass spectrometric detection: Final technical progress report, September 1, 1989–January 31, 1993.** Sepaniak, M.J.; Cook, K.D. Tennessee Univ., Knoxville, TN (United States). Dept. of Chemistry. [1992]. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-86ER13613. Order Number DE92040524. Source: OSTI; NTIS; GPO Dep.

In the years following the 1986 seminal paper (J. Chromatogr. Sci., 24, 347-352) describing modern capillary zone electrophoresis (CZE), the prominence of capillary electrokinetic separation techniques has grown. A related electrochromatographic technique is micellar electrokinetic capillary chromatography (MECC). This report presents a brief synopsis of research efforts during the current 3-year period. In addition to a description of analytical separations-based research, results of efforts to develop and expand spectrometric detection for the techniques is reviewed. Laser fluorometric detection schemes have been successfully advanced. Mass spectrometric research was less fruitful, largely owing to personnel limitations. A regenerable fiber optic sensor was developed that can be used to remotely monitor chemical carcinogens, etc. (DLC)

1132 (DOE/ER/13659–6) **New high temperature plasmas and sample introduction systems for analytical atomic emission and mass spectrometry: Progress report, January 1, 1990–December 31, 1992.** Montaser, A. George Washington

Univ., Washington, DC (United States). Office of Sponsored Research. [1992]. 40p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-87ER13659. Order Number DE92040602. Source: OSTI; NTIS; GPO Dep.

New high temperature plasmas and new sample introduction systems are explored for rapid elemental and isotopic analysis of gases, solutions, and solids using mass spectrometry and atomic emission spectrometry. Emphasis was placed on atmospheric pressure He inductively coupled plasmas (ICP) suitable for atomization, excitation, and ionization of elements; simulation and computer modeling of plasma sources with potential for use in spectrochemical analysis; spectroscopic imaging and diagnostic studies of high temperature plasmas, particularly He ICP discharges; and development of new, low-cost sample introduction systems, and examination of techniques for probing the aerosols over a wide range. Refs., 14 figs. (DLC)

1133 (DPW–5331) **Ion exchange coupling - activity experiments.** Watt, G.W. Du Pont de Nemours (E.I.) and Co., Wilmington, DE (United States). Explosives Dept. 7 May 1952. 2p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-76SR00001. (SR/H–215). Order Number DE93001242. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report discusses the buildup of zirconium on Dowex 50 resin columns of the type anticipated for use at Savannah River Plant. This report is dated May 7, 1952. (JL)

1134 (FRCEA-TH–369) **Application of crown ethers to selective extraction and quantitative analysis of technetium 99, iodine 129 and cesium 135 in effluents.** Paviet, P. CEA Centre d'Etudes de Cadarache, 13 - Saint-Paul-lez-Durance (France). Dept. Stockage Dechets; Paris-11 Univ., 91 - Orsay (France). 23 Jun 1992. 210p. (In French). Order Number DE93721139. Source: OSTI; NTIS (US Sales Only); INIS.

Properties of crown ethers are first recalled. Then extraction of technetium 99 is studied in actual radioactive effluents. Quantitative analysis is carried out by liquid scintillation and interference of tritium is corrected. Iodine 129 is extracted from radioactive effluents and determined by gamma spectrometry. Finally cesium 135 is extracted and determined by thermo ionization mass spectroscopy.

1135 (INIS-BR–2933, pp. 219) **Detection limit determination of metallic traces in high purity tantalum powder.** Izario Filho, H.J. (Fundacao de Tecnologia Industrial (FTI), Lorena, SP (Brazil). Centro de Materiais Refratarios); Silva, M.L.C. da. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. TANTALUM/matrix materials; EMISSION SPECTROSCOPY; IMPURITIES; POWDERS; SENSITIVITY; TANTALUM; TRACE AMOUNTS

1136 (INIS-mf–13349, pp. 37) **Measuring trace amount of elements distribution in the atmospher of Tehran by instrumental neutron activation analysis.** Honarkhah, H.R. (Atomic Energy Organization of Iran (Iran, Islamic Republic of) Gamma Irradiation Center); Sohrabpour, M.; Mirehydari, F.; Rafiaie, H. Iranian Physics Society, Teheran (Iran, Islamic Republic of). 1991. 53p. (In Persian). (CONF-9109417–: Iran's physics conference, Isfahan (Iran, Islamic Republic of), 10 Sep 1991). In *Abstract of articles from Iran's physics conference.* Order Number DE93000811. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. AIR/neutron activation analysis; AIR; ANTIMONY; BROMINE; CHROMIUM; COBALT; DISTRIBUTION; ELEMENTS; IRAN; IRON; SAMARIUM; SODIUM; TRACE AMOUNTS

1137 (INIS-mf–13371, pp. 4-6) **PIXE analysis of waters in checking pollutant transfer in shallow waters: Annex 3.** Cecchi, R.; Ghermandi, G.; Zonta, R. United Nations Educational, Scientific and Cultural Organization (UNESCO), 75 - Paris (France). Intergovernmental Oceanographic Commission (IOC). 1991. (CONF-9105381–: IOC-UNEP review meeting on oceanographic processes of transport and distribution of pollutants in the sea, Zagreb (Yugoslavia), 15 May 1991). In *IOC-UNEP review meeting on oceanographic processes of transport and distribution of pollutants in the sea.* 29p. Order Number DE93605070. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 7 refs. MEDITERRANEAN SEA/seawater; SEAWATER/multi-element analysis; SEAWATER/pixe analysis; CADMIUM; COASTAL WATERS; COPPER; LEAD; SEAWATER; MERCURY; NICKEL; SEDIMENTS; WATER POLLUTION

1138 (IS-T–1630) **Novel detection schemes and automated image analysis algorithms for planar chromatography and gel electrophoresis.** Koutney, L.B. Ames Lab., IA (United States). 9 Sep 1992. 211p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-82. Order Number DE93001219. Source: OSTI; NTIS; GPO Dep.

After a discussion of charge coupled devices and personal computer capabilities, examples of their applications involving novel analytical techniques are presented: laser-based indirect fluorometric detection in thin-layer chromatography; on-line detection of DNA and proteins in gel electrophoresis by uv absorption; automated image analysis for distortion compensation in sequencing gel electrophoresis; and expert systems for data acquisition to achieve constant signal-to-noise, with application to DNA sequencing slab gels.

1139 (KAERI/RR–999/91) **Development of laser technology: Development of laser atomic spectroscopic technology.** Lee, Jong Min (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Cha, Hyung Ki; Yoo, Byung Duk. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Jul 1991. 186p. (In Korean). Order Number DE93605123. Source: OSTI; NTIS (US Sales Only); INIS.

The goal of the project is to develop an efficient detection method of heavy metal elements of trace amount. In this year, a Nd:YAG laser and a dye laser were designed and constructed. Also a high vacuum chamber and TOF mass spectrometer for ion analysis were made. With these equipment, photoionization experiments and elemental analyses were performed for Pb and Cd. This study is thought to provide technological resolution for severe social problems arising from the harmful pollution due to heavy metal elements, and for the analysis of atomic elements utilized in the nuclear industries. (Author).

1140 (KCP–613-4841) **Peristaltic pumps for waste disposal.** Griffith, G.W. Allied-Signal Aerospace Co., Kansas City, MO (United States). Kansas City Div. Sep 1992. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00613. (CONF-9210172–1: ISLAR '92: international symposium on laboratory automation and robotics, Boston, MA (United States), 25-28 Oct 1992). Order Number DE93000399. Source: OSTI; NTIS; INIS; GPO Dep.

Laboratory robots are capable of generating large volumes of hazardous liquid wastes when they are used to perform chemical analyses of metal finishing solutions. A robot at Allied-Signal Inc., Kansas City Division, generates 30 gallons of acid waste each month. This waste contains mineral acids, heavy metals, metal fluorides, and other materials. The waste must be contained in special drums that are closed to the atmosphere. The initial disposal method was to have the robot pour the waste into a collecting funnel, which contained a liquid-sensing valve to admit the waste into the drum. Spills were inevitable, splashing occurred, and the special valve often didn't work well. The device also occupied a large amount of premium bench space. Peristaltic pumps are made to handle hazardous liquids quickly and efficiently. A variable-speed pump, equipped with a quick-loading pump head, was mounted below the robot bench near the waste barrel. The pump inlet tube was mounted above the bench within easy reach of the robot, while the outlet tube was connected directly to the barrel. During operation, the robot brings the waste liquid up to the pump inlet tube and activates the pump. When the waste has been removed, the pump stops. The procedure is quick, simple, inexpensive, safe, and reliable.

1141 (LBL–32430) **Separation of compounds with multiple -OH groups from dilute aqueous solutions via complexation with organoboronate.** Chow, Tina Kuo Fung. Lawrence Berkeley Lab., CA (United States). May 1992. 80p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. Order Number DE92041201. Source: OSTI; NTIS; GPO Dep.

The complexing extractant agent investigated in this work is 3-nitrophenylboronic acid (NPBA) in its anionic form (NPB). NPBA and Aliquat 336 (quaternary amine) is dissolved in 2-ethyl-l-hexanol, and the extractant is contacted with aq. NaOH. Solutes investigated were 1,2-propanediol, glycerol, fructose, sorbitol and lactic acid. Batch extraction experiments were performed at 25°C. Partition coefficients, distribution ratios and loadings are reported for varying concentrations of solute and NPB. All solutes complexed with NPB^-, with all complexes containing only one NPB^- per complex. The 1:1 complexation constants for the solutes glycerol, fructose and sorbitol follow trends similar to complexation with $B(OH)_4^-$ (aq.), i.e. the complexation constants increase with increasing number of –OH groups available for complexation. Assumption of 1:1 complex is not valid for 1, 2-propanediol, which showed overloading (more than one mole of solute complexed to one mole NPB^-) at higher concentrations. The –OH group on the NPB^- which is left uncomplexed after one solute molecule had bound to the other two –OH groups may be responsible for the overloading. Overloading is also observed in extraction of tactic acid, but through a different mechanism. It was found that $TOMA^+$ can extract lactic acid to an extent comparable to the uptake of lactic acid by NPB^-. The complexation is probably through formation of an acid-base ion pair. Losses of NPBA into the aqueous phase could lead to problems, poor economics in industrial separation processes. One way of overcoming this problem would be to incorporate the NPBA onto a solid support.

1142 (PCCF-RI–92-01) **Study by neutron activation analysis and by X-ray diffraction of ossification kinetics of coral implanted in pig cortex.** Irigaray, J.L.; Oudadesse, H.; Sauvage, T. Clermont-Ferrand-2 Univ., 63 - Aubiere (France). Lab. de Physique Corpusculaire. 1992. 37p. (In French). Order Number DE93721055. Source: OSTI; NTIS (US Sales Only); INIS.

Inorganic chemical composition of coral implanted in vivo is studied by neutron activation. Ca, P, Sr and Mg are determined for various implantation time (1 to 24 weeks), after a latent period of one week calcium content of coral increase up to 6 weeks to attain mean content of bones, phosphorus content increase up to 12 weeks, strontium decrease rapidly and magnesium decrease slightly during the first week and increase up to 10 weeks. Then crystal structure of coral after implantation is studied by X-ray diffraction.

1143 (PCCF-T–91-03) **Thermoluminescence dating. Application to the chronology of volcanic ashes.** Pilleyre, T. Clermont-Ferrand-2 Univ., 63 - Aubiere (France). Lab. de Physique Corpusculaire. Sep 1991. 164p. (In French). Order Number DE93721054. Source: OSTI; NTIS (US Sales Only); INIS.

Thermoluminescent (TL) dating is generally used for minerals heated in the past and can be used for absolute chronology of volcanic ashes but seems limited to less than 15.000 years. The aim of the thesis is the study of thermoluminescent properties of quartz for high doses and long irradiations using the red TL peak of quartz which is situated at high temperature (about 370 deg. C) to extend the method for higher ages. A theory, based on spatial correlation between electron and hole created during the same ionization, is developed. A chapter is devoted to dosimetry because of its importance in TL dating, especially alpha scintillation counting and the influence of humidity on the determination of annual dose. Volcanic samples are dated from 10.000 to 80.000 years before present.

1144 (SER/CDM–28) **Coulometric determination of uranium using platinum and mercury electrodes.** Chegrouche, Salah (Centre de Developpement des Materiaux, Algiers (Algeria). Labo. d'Analyse); Mousty, Francis. Secretariat d'Etat a la Recherche, Algiers (Algeria). Jul 1992. 19p. (In French). Order Number DE93605124. Source: OSTI; NTIS (US Sales Only); INIS.

The present paper describes the uranium controlled potential coulometric titration technique in sulfuric acid media using two different electrodes: the mercury and the platinum electrode. The platinum electrode presents several important practical advantages compared to that of mercury. Using the platinum electrode, the uranium coulometric oxidation from state IV to VI is feasible and the couples of iron (III) and uranium (IV) or plutonium (IV) and uranium (IV) determination can be realised with the same electrode and the same solution the uranium and iron or plutonium quantity which reacted is calculated using coulombs number necessary to obtain either the total oxidation or reduction of the elements of interest.

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Refer also to citation(s) 44, 276, 426, 434, 1012, 1087, 1088, 1183, 1185, 1187, 1678, 2084, 2355

1145 (AECL–10374) **Modelling electric discharge chemistry.** McFarlane, J.; Wren, J.C. Atomic Energy of Canada Ltd., Pinawa, MB (Canada). Whiteshell Nuclear Research Establishment. Jul 1991. 100p. Order Number DE93603766. Source: OSTI; NTIS (US Sales Only); INIS.

The chemistry occurring in a electric discharge was modelled to predict how it would be influenced by discharge conditions. The discharge was characterized by a calculated Boltzmann electron-energy distribution, from which rate constants for electron-molecule processes in air were determined. These rate constants were used in a chemical kinetics calculation that also included reactions between neutral molecules, ions, free radicals and electronically excited species. The model describes how the discharge chemistry was influenced by humidity, electric field, electron number density, and concentrations of key reagents identified in the study. The use of an electric discharge to destroy airborne contaminant molecules was appraised, the targeted contaminants being CF_2Cl_2, HCN, and SO_2. The modelling results indicate that an electric discharge should be able to remove HCN and CF_2Cl_2 effectively, especially if the discharge conditions have been optimized. Effective destruction is achieved with a moderate electric field (over 1×10^{-15} $V.cm^2$), a substantial electron number density (over 1×10^{12} cm^{-3}), and the presence of H_20 in the process air. The residence time in the discharge was also shown to be important in contaminant destruction. An attempt was made to explain the results of the electric discharge abatement of SO_2, a component of a simulated flue-gas mixture. Results from the model indicate that the discharge parameters that increase the concentration of hydroxyl radical also increase the rate of decomposition of SO_2. An objective of the study was to explain the apparent enhancement of SO_2 destruction by the presence of a small amount of NO_2. It was thought that a likely explanation would be the stabilization of $HOSO_2$, an important intermediate in the oxidation of SO_2 by NO_2. (49 figs., 14 tabs., 75 refs.).

1146 (AECL–10402) **The cathodic reduction of dioxygen on uranium oxide in dilute alkaline aqueous solution.** Hocking, W.H.; Betteridge, J.S.; Shoesmith, D.W. Atomic Energy of Canada Ltd., Pinawa, MB (Canada). Whiteshell Nuclear Research Establishment. Sep 1991. 142p. Order Number DE93603176. Source: OSTI; NTIS (US Sales Only); INIS.

The cathodic reduction of dioxygen on uranium oxide in dilute alkaline aqueous solutions has been investigated within the context of a program to develop a comprehensive model to predict the behaviour of used CANDU (Canada Deuterium Uranium) nuclear fuel under disposal-vault conditions. Two different kinds of ceramic UO_2 were studied: reactor-grade CANDU fuel with normal p-type electrical conductivity and low-resistance material that exhibits n-type photoelectrochemical behaviour. The transport of electroactive species in solution was controlled by varying the rotation rate of rotating disc electrodes (RDE) and rotating ring-disc electrodes (RRDE). Steady-state polarization measurements were made using the current-interrupt method to compensate for the potential drop caused by ohmic resistance. Any release of peroxide to solution from the UO_2 (disc) surface could be monitored by oxidizing it at the Au ring of an RRDE. The existing theory for the cathodic 0_2-reduction process as applied to RDE and RRDE experiments has been reviewed as a starting point for the interpretation of the results obtained in our work. (37 figs., 2 tabs., 170 refs.).

1147 (ANL/CP–76412) **Kinetic studies of reactions of cobalt clusters with deuterium.** Ho, J.; Zhu, L.; Parks, E.K.; Riley, S.J. Argonne National Lab., IL (United States). [1992]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-920921–4: 6. international symposium on small particles and inorganic clusters, Chicago, IL (United States), 16-22 Sep 1992). Order Number DE93000514. Source: OSTI; NTIS; GPO Dep.

The kinetics of chemical reactions of cobalt clusters Co_n with deuterium are described. Absolute rate constants have been measured in the cluster range n = 7–68 at 293 K. The rate constants are found to be a strong function of cluster size, varying by up to three orders of magnitude. This size , dependence is most prominent in the n = 7–25 size range: CO_{15} is the most reactive cluster, and CO_{7-9} and CO_{19--20} are particularly unreactive. Abrupt changes in the rate constants from one cluster size to the next are observed. For the clusters above n = 25, the rate constants show several less prominent maxima and minima superimposed on a slow, nearly monotonic increase with cluster size.

1148 (BARC–1992/E/007) **The synthesis and characterisation of some aliphatic monoamides and diamides.** Ruikar, P.B. (Bhabha Atomic Research Centre, Bombay (India). Radiochemistry Div.); Prabhu, D.R.; Mahajan, G.R.; Nagar, M.S.; Nair, G.M.; Subramanian, M.S. Bhabha Atomic Research Centre, Bombay (India). 1992. 12p. Order Number DE93605138. Source: OSTI; NTIS (US Sales Only); INIS.

This report summarises the synthesis and characterisation of several symmetrical, unsymmetrical and branched chain amides which have potential application as alternate extractants to TBP in the Purex Process. Some substituted diamides which have importance in the removal of actinides from transuranium waste have also been synthesised and characterised. The amides contents determined by nonaqueous potentiometric titration indicate a purity of 97-100%. The relative basicity of these amides and diamides have been determined by measuring the equilibrium constants for the uptake of nitric acid by them. The streching frequency of their carbonyl bond has also been listed. (author). 26 refs., 3 tabs.

1149 (CONF-9206274–2) **Cavity-enhanced spontaneous emission rates for rhodamine 6-G in levitated microdroplets.** Barnes, M.D. (Oak Ridge National Lab., TN (United States)); Whitten, W.B.; Ramsey, J.M.; Arnold, S. Oak Ridge National Lab., TN (United States). [1992]. 16p. Sponsored by USDOE, Washington, DC (United States); National Science Foundation, Washington, DC (United States). Grant ATM-89-175871. From US Army Chemical Research Development Engineering Center (CRDEC) conference on obscuration and aerosol research; Aberdeen Proving Grounds, MD (United States); 22-26 Jun 1992. Order Number DE93000439. Source: OSTI; NTIS; INIS; GPO Dep.

Fluorescence decay kinetics of Rhodamine 6-G molecules in levitated glycerol microdroplets (4–20 microns in diameter) have been investigated to determine the effects of spherical cavity resonances on spontaneous emission rates. For droplet diameters greater than 10 microns, the fluorescence lifetime is essentially the same as in bulk glycerol. As the droplet diameter is decreased below 10 microns, bi-exponential decay behavior is observed with a slow component whose rate is similar to bulk glycerol, and a fast component whose rate is as much as a factor of 10 larger than the bulk decay rate. This fast component is attributed to cavity enhancement of the spontaneous emission rate and, within the weak coupling approximation, a value for the homogeneous linewidth at room temperature can be estimated from the fluorescence lifetime data.

1150 (CONF-9210161–3) **Resonance electron scattering by adsorbed molecules: σ^* resonance energy versus bond length.** Siller, L. (Cambridge Univ. (United Kingdom). Cavendish Lab.); Hock, K.M.; Palmer, R.E.; Wendelken, J.F. Oak Ridge National Lab., TN (United States). [1992]. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 12. international vacuum congress; Hague (Netherlands); 12-16 Oct 1992. Order Number DE93000445. Source: OSTI; NTIS; GPO Dep.

The paper explores the relationship between the energy of the σ^* negative ion resonance, observed in the cross-section for vibrational excitation of small molecules in electron energy loss spectroscopy (EELS), and the intramolecular bond length. On the basis of experimental results assembled from studies of electron scattering by both fire and adsorbed molecules containing the C-0 group, we find an approximately linear empirical correlation between the resonance energy and the C-0 bond length. This correlation is accurately reproduced by multiple scattering $X\alpha$ calculations for the free CO molecule as a function of bond length, suggesting the possible determination of molecular bond lengths from the σ^* resonance energies obtained in EELS. Similar calculations are reported for N_2 and 0_2 in addition to CO.

1151 (DOE/CE/23810–3A) **Thermophysical properties: Quarterly report, 1 April 1992–30 June 1992.** Kayser, R.F. National Inst. of Standards and Technology (IMSE), Gaithersburg, MD (United States). Jul 1992. 52p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-91CE23810. Order Number DE93000493. Source: OSTI; NTIS; GPO Dep.

Numerous fluids have been identified as promising alternative refrigerants, but much of the information needed to predict their behavior as pure fluids and as components in mixtures does not exist. In particular, reliable thermophysical properties data and models are needed to predict the performance of the new refrigerants in heating and cooling equipment, and to design and optimize equipment to be reliable and energy efficient. The objective of this project is to provide highly accurate, selected thermophysical properties data for Refrigerants 32, 123, 124, and 125, and to use these data to fit simple and complex equations of state and detailed transport property models. The new data will fill gaps in the existing data sets and resolve the problems and uncertainties that exist in and between the data sets. This report describes the progress made during the second quarter of this fifteen-month project, which was initiated in late January, 1992.

1152 (DOE/ER/13290–8) **Chemistry of oxygenates on transition metal surfaces: Activation of C- H, C-C, and C-O bonds: Progress report, December 15, 1991.** Delaware Univ., Newark, DE (United States). [1991]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-84ER13290. Order Number DE92040843. Source: OSTI; NTIS; GPO Dep.

Goal is to understand the requirements for and competition between activation of C-H, C-C, and C-O bonds in the synthesis and decomposition of oxygenates on transition metal surfaces. Efforts during the past year was devoted primarily to the role of activation of β-CH bonds in decarbonylation of higher oxygenates on surfaces of metals such as Rh and Pd; studies were completed of more than a dozen C_1-C_3 oxygenates on Rh(111), and progress was made with reagents for which β-CH scission is blocked. It is shown that alcohols and aldehydes do not react via a common pathway on on Rh(111). Ethanol and acetaldehyde are formed from CO + H_2 by parallel routes on Rh catalysts which do not contain interacting supports or oxide promoters; i.e., the two compounds result from CO insertion into different metal-hydrocarbon bonds. Aldehydes decarbonylate via α-CH scission to form acyl, followed by C-C scission to release an alkyl ligand; this ligand undergoes hydrogenation and dehydrogenation steps. Alcohols form surface alkoxides, but these do not dehydrogenate further to the aldehydes, they release CO + H_2 but no volatile hydrocarbon. These results indicate that β-CH scissors to form a surface oxametallacycle intermediate; supporting evidence is spresented for this intermediate. Chemistry of alcohols blocked to different extends at the β-position was also studied; complete blocking (CF_3CH_2OH) forces the reaction to follow the aldehyde-acyl path, while partial substitution at the β position (branched alcohols) favors the oxametallacycle pathway. (DLC)

1153 (DOE/ER/13463–9) **Novel macrocyclic carriers for proton-coupled liquid membrane transport: Progress report, December 1, 1991–November 30, 1992.** Lamb, J.D.; Bradshaw, J.S.; Izatt, R.M. Brigham Young Univ., Provo, UT (United States). Dept. of Chemistry. Jul 1992. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-86ER13463. Order Number DE93003160. Source: OSTI; NTIS; GPO Dep.

A number of new macrocyclic ligands was prepared for transport studies. The cryptands were prpepared (18-40% yield) by a new metal carbonate-catalyzed one-step method from 1 mole

oligoethyleneoxy diamine and 2 moles diahlide derivative of oligoethylene glycol. Bis-crown ethers were also isolated in 17-30% yields. Cage compounds were also prepared; they interact with various metal ions and protons. Back extraction and dual module hollow fiber membrane separation experiments were used to study the cation selectivity of new ligands, including crown thioethers. An isothermal flow calorimeter is being constructed for studies of macrocycle-cation reactions. 3 figs, 2 tabs.

1154 (DOE/ER/13626–6) **Morphological aspects of surface reactions: Progress report, September 1991–August 1992.** White, J.M. Texas Univ., Austin, TX (United States). Dept. of Chemistry. Aug 1992. 23p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-86ER13626. Order Number DE92040522. Source: OSTI; NTIS; GPO Dep.

This program involves the preparation and characterization (both structural and kinetic) of metal-based catalysts and adsorbates thereon. The substrates involve mainly Rh and Ag; oxides of Si, Al and Ti are used for supports for particles and thin metal films. Adsorbates include carbon oxides, halogenated hydrocarbons, benzene and alkalis. Particular attention is given to synthesis of hydrocarbon fragments by photochemical and electron-induced methods. Tunneling microscopy and spectroscopy are used to study the morphology and electronic structure of the metals. (DLC)

1155 (DOE/ER/13943–02) **Theoretical and experimental study of mixed solvent electrolytes: Final report, July 1, 1988–December 31, 1991.** Cummings, P.T.; O'Connell, J.P. Virginia Univ., Charlottesville, VA (United States). Dept. of Chemical Engineering. Jul 1991. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-88ER13943. (UVA–527381/CHE91/102). Order Number DE93001847. Source: OSTI; NTIS; GPO Dep.

The goals of the research program have evolved into the following: Molecular simulation of phase equilibria in aqueous and mixed solvent electrolyte solutions; molecular simulation of solvation and structure in supercritical aqueous systems; extension of experimental database on mixed solvent electrolytes; analysis of the thermodynamic properties of mixed solvent electrolyte solutions and mixed electrolyte solutions using fiuctuation solution theory; development of analytic expressions for thermodynamic properties of mixed solvent electrolyte solutions using analytically solved integral equation approximations; and fundamental modeling of mixed solvent electrolytes using numerically solved integral equation approximation theories. We report and evaluate our progress during the period of the grant in light of these six goals in detail in this paper.

1156 (DOE/ER/14080–3) **Development of an experimental data base and theories for prediction of thermodynamic properties of aqueous electrolytes and nonelectrolytes of geochemical significance at supercritical temperatures and pressures: Annual performance report.** Wood, R.H. (Delaware Univ., Newark, DE (United States). Dept. of Chemistry and Biochemistry); Hnedkovsky, L.; Lin, Ching Lung; Shock, E.L. Delaware Univ., Newark, DE (United States). Dept. of Chemistry and Biochemistry. 24 Feb 1992. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-89ER14080. Order Number DE92040856. Source: OSTI; NTIS; GPO Dep.

This project is divided into method experimental measurements, theoretical development, and geochemical applications. We have completed experimental volumetric measurements on aqueous solutions of CO_2 H_2S, CH_4, NH_3 and $B(OH)_3$ at 25 to 432°C and 280 and 350 bar. A vibrating tube densitometer that allows density measurements near bubble point and also measures the bubble pressure was developed and used to measure densities and bubble pressures of aqueous Co_2. Heat capacity measurements should be completed by the end of the grant period. Simulations of models for methane in water at temperatures to 1000°C are in progress. In order to facilitate these free energy calculations the possible errors associated with the calculations have been explored in two papers (Wood, 1991; Wood et al., 1991) and methods of controlling and estimating these errors have been developed. Applications of the new data to geochemical processes is now possible. Efforts have focussed on extracting equilibrium constants for carbonic acid dissociation at supercritical condition from published experiments on mineral equilibria in H_20-CO_2 fluids (Boehlke and Shock, 1990; and in prep.). As a result, estimates of pKa for carbonic acid are now available at temperatures from 300 to 750°C and pressures from 1 to 7 kilobars. They will be combined with $\bar{V}^\circ$ and $\bar{C}p^\circ$ data for CO^2(aq) to improve geochemical calculations.

1157 (DOE/ER/14161–2) **Spectroscopic investigation of the vibrational quasi-continuum arising from internal rotation of a methyl group: Progress report, September 15, 1991–September 14, 1992.** Hougen, J.T. National Inst. of Standards and Technology, Gaithersburg, MD (United States). Molecular Physics Div. [1992]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AI05-90ER14161. Order Number DE93001389. Source: OSTI; NTIS; GPO Dep.

Acetaldehyde was studied. The investigation of the ground electronic state has three parts: the internal-rotor manifold, the traditional vibrational manifold, and interactions between internal rotation and ordinary vibrations. Progress is reported for each.

1158 (DOE/ER/45151–T1) **Microscopic physical and chemical properties of graphite intercalation compounds: Final report, August 1, 1984–July 31, 1985.** Eklund, P.C. Kentucky Univ., Lexington, KY (United States). Dept. of Physics and Astronomy. 24 Aug 1992. 59p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-84ER45151. Order Number DE93001701. Source: OSTI; NTIS; GPO Dep.

Optical spectroscopy (Raman, FTIR and Reflection) was used to study a variety of acceptor- and donor-type compounds synthesized to determine the microscopic models consistent with the spectrocsopic results. General finding is that the electrical conduction properties of these compounds can be understood on the basis that the intercalation of atomic and/or molecular species between the host graphite layers either raises or lowers the Fermi level (E_{Fi}) in a graphitic band structure. This movement of E_F is accomplished via a charge transfer of electrons from the intercalate layers to the graphitic layers (donor compounds), or vice versa (acceptor compounds). Furthermore, the band structure must be modified to take into account the layers of charge that occur as a result of the charge transfer. This charge layering introduces additional bands of states near E_F, which are discussed. Charge-transfer also induces a perturbation of the graphitic normal mode frequencies which can be understood as the result of a contraction (acceptor compounds) or expansion (donor compounds) of the intralayer C-C bonds. Ab-initio calculations support this view and are in reasonable agreement with experimental data.

1159 (DOE/PC/90292–T6) **Alternative formulations of regenerable flue gas cleanup catalysts: Progress report, December 1, 1991–February 29, 1992.** Mitchell, M.B.; White, M.G. Clark Atlanta Univ., GA (United States). [1992]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-90PC90292. Order Number DE92041247. Source: OSTI; NTIS; GPO Dep.

During this quarter, we have investigated the impregnation of a high purity Goodfellow γ-alumina with magnesium acetylacetonate dehydrate [$Mg(acac)_2 \cdot 2H_2O$], and the loading as a function of impregnation solution concentration. We focus on the loading of complex as a function of initial amount of complex in solution and the stoichiometry of the supported metal complex. The goal is to obtain a monolayer film of the metal complex on the support.

1160 (IC–92/198) **Atomic size effects on local coordination and medium range order in molten trivalent metal chlorides.** Tatlipinar, H. (International Centre for Theoretical Physics, Trieste (Italy)); Akdeniz, Z.; Pastore, G.; Tosi, M.P. International Centre for Theoretical Physics, Trieste (Italy). Aug 1992. 25p. Order Number DE93605139. Source: OSTI; NTIS (US Sales Only); INIS.

Structural correlations in molten trivalent metal chlorides are evaluated as functions of the metal ion size R_M across the range from $LaCl_3$ (R_M approx. 1.4 A) to $AlCl_3$ (R_M approx. 0.8 A), using a charged soft-sphere model and the hypernetted chain approximation. Main attention is given to trends in the local liquid structure (partial radial distribution functions, coordination numbers and bond lengths) and in the intermediate range order (first sharp diffraction peak in the number-number and partial structure factors). The

trend towards fourfold local coordination of the metal ions, the stabilization of their first-neighbour chlorine cage and the growth of medium range order are found to proceed in parallel as the size of the metal ion is allowed to decrease at constant number density and temperature. A tendency to molecular-type local structure and liquid-vapour phase separation is found within the hypernetted chain scheme at small metal ion sizes corresponding to $AlCl_3$ and is emphasized by decreasing the number density of the fluid. The predicted molecular units are rather strongly distorted Al_2Cl_6 dimers, in agreement with observation. The calculated structural trends for other trichlorides are compared with diffraction and transport data. (author). 17 refs, 8 figs, 1 tab.

1161 (INIS-BR–2933, pp. 215) **Study on calcination of ammonium paratungstate.** Silva, A.G.P. da (Fundacao de Tecnologia Industrial (FTI), Lorena, SP (Brazil). Centro de Materiais Refratarios); Gomes, U.U. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. AMMONIUM TUNGSTATES/evaporation; EVAPORATION; CALCINATION; TRANSITION TEMPERATURE; X-RAY DIFFRACTION

1162 (INIS-BR–2933, pp. 239) **Effect of nitrogen as interstitial solute on Nb-50% p. Ti.** Florencio, O. (Sao Carlos Univ., SP (Brazil). Dept. de Fisica); Oliveira, H.A. de; Jordao, J.A.R.; Grandini, C.R.; Francisco, R.H.P.; Botta Filho, W.J.; Rodrigues, J.A. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. NIOBIUM ALLOYS/solubility; CRYSTAL DOPING; INTERNAL FRICTION; INTERSTITIALS; SOLUBILITY; NITROGEN; TEMPERATURE RANGE 0065-0273 K; TEMPERATURE RANGE 0273-0400 K; TITANIUM; X-RAY DIFFRACTION

1163 (INIS-BR–2933, pp. 293) **Study on polymer ion conductors by NMR.** Cavalcante, M.G. (Sao Paulo Univ., Sao Carlos, SP (Brazil). Inst. de Fisica e Quimica); Donoso, J.P. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. POLYMERS/ionic conductivity; POLYMERS/nuclear magnetic resonance; CALORIMETRY; HYDRATION; INFRARED SPECTRA; POLYMERS; THERMAL GRAVIMETRIC ANALYSIS; TRANSITION TEMPERATURE

1164 (INIS-BR–2933, pp. 307) **Larmor frequency dependence of spin-lattice and dipolar relaxation time in thermotropic liquid crystals.** Anoardo, E. (Universidad Nacional de Cordoba (Argentina). Fac. de Matematica, Astronomia y Fisica); Pusiol, D.J. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Spanish). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. LIQUID CRYSTALS/spin-lattice relaxation; SPIN-LATTICE RELAXATION/frequency dependence; SPIN-LATTICE RELAXATION/larmor precession; DIPOLES; MAGNETIC FIELDS; RELAXATION TIME

1165 (INIS-BR–2933, pp. 364) **Photoelectrochemical characterization of cadmium sulfide films.** Juliao, J.F. (Ceara Univ., Fortaleza, CE (Brazil). Dept. de Fisica); Matias, J.G.N.; Chagas, J.W.R. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. CADMIUM SULFIDES/electrodeposition; ELECTRODEPOSITION; CARRIER DENSITY; DIFFUSION; ELECTRIC CONDUCTIVITY; ENERGY GAP; FILMS; HEAT TREATMENTS; OPTICAL PROPERTIES; SUBSTRATES; TEMPERATURE DEPENDENCE; TITANIUM; TRANSPORT

1166 (INIS-BR–2933, pp. 376) **Study on electrical characteristics of Nb/Nb_2O_5 (anodic growth)/Nb junctions.** Silva, S.W. da (Sao Carlos Univ., SP (Brazil)); Camrgo, P.C. de. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. FILMS/electric conductivity; CRYSTAL GROWTH; CURRENT DENSITY; EVAPORATION; FILMS; NIOBIUM; NIOBIUM OXIDES; SPECTROSCOPY; TEMPERATURE DEPENDENCE

1167 (INIS-BR–2933, pp. 376) **Dielectrical constant of anodic films of the niobium pentoxide.** Juliao, J.F. (Ceara Univ., Fortaleza, CE (Brazil). Dept. de Fisica); Dias, N.L.; Silva Filho, H.F. da. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. NIOBIUM OXIDES/dielectric properties; CRYSTAL GROWTH; CURRENT DENSITY; ELECTROLYTES; FILMS; TEMPERATURE DEPENDENCE

1168 (IS-T–1607) **Theoretical and experimental methods for in situ infrared spectroelectrochemistry of organic monomolecular films.** Popenoe, D.D. Ames Lab., IA (United States). 9 Sep 1992. 320p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-82. Order Number DE93001222. Source: OSTI; NTIS; GPO Dep.

Thesis submitted to Iowa State University.

This work describes the theoretical analysis, experimental development, and application of an in situ spectroelectrochemical cell for measuring infrared reflection-absorption spectra (IRRAS) of monolayer-coated Au surfaces beneath a thin aqueous overlayer. The cell allows the interchange of sample and reference substrates, thereby facilitating IRRAS of long-chain alkanethiolates in the C-H stretching region without electrochemical or polarization-modulation methods. The same in situ cell is combined with electrochemical modulation to study monolayers self-assembled from 11-mercaptoundecyl ferrocenecarboxylate ($FcCOOC_{11}SH$) at gold and to correlate the monolayer structure and composition with the ferrocenyl redox chemistry. An electrochemically active monolayer of an alkanethiolate derivatized with a flavin, formed by self-assembly from ethanolic solutions of 11,11'-dithiobisundecanoic acid, bis[2-(7,8-dimethyl-10-isoalloxazino)ethyl] ester, is described. IRRAS of the film, which is a candidate for future in situ spectroscopic studies, are presented and compared with transmission spectra of bulk analogs.

1169 (IS-T–1620) **Distance analysis of Patterson calculations and molecular mechanics as aids in structure solution.** Day, C.L. Ames Lab., IA (United States). 9 Sep 1992. 142p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-82. Order Number DE93001224. Source: OSTI; NTIS; GPO Dep.

Two methods (SUPSYMM and MMXRAY) for crystal structures insoluble through normal crystallography have been developed. SUPSYMM needs only a list of Patterson superposition peaks as its starting point. Using distance analysis and vector projections, symmetry relations between the superposition peaks are identified

which are exploited to identify probable peak positions for least-squares refinement. MMXRAY solves large organometallic structures by using Patterson superposition and molecular mechanics. Patterson superposition techniques can usually locate at least the heavy atoms. Molecular mechanics is used to model the remaining organic parts of the structure. MMXRAY converts the modeled structure to the original crystallographic reference system. Two programs designed to teach the basics of both powder and single crystal X-ray diffraction methods to undergraduate physical chemistry students are presented in the Appendix. Several crystal structures solved through routine crystallographic routes are also discussed.

1170 (KAERI/RR–1073/91) **A study on the separation characteristics of tritiated water vapor adsorption-II.** Sung, Ki Woung (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Kim, Yong Eak; Na, Jung Won; Kim, Kwang Rak; Ahn, Do Hee; Chung, Hoong Suck; Cho, Young Hyun; Park, Soong Woo; Kim, In Won. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Jan 1991. 123p. (In Korean). Order Number DE93605210. Source: OSTI; NTIS (US Sales Only); INIS.

In order to meet a small tritiated heavy water leakage in the heavy water nuclear reactor building, it is required to increase the sorption efficiency of adsorbent and sorption performance of the present heavy water vapor recovery system. Accordingly, the equilibrium charcteristics of sorption of zeolite molecular sieve 13X and 4A were investigated, and the 4A was confirmed as a substitute of 13X. Furthermore, the pressure swing sorption mechanism was confirmed as a higher efficient substitute of the present temperature swing process, and the detailed design, operational condition and the detailed manufacturing method of it was suggested. (Author).

1171 (LBL–31675) **Investigations of hydrodenitrogenation of quinoline over molydenum nitride.** Lee, K.S.; Reimer, J.A.; Bell, A.T. Lawrence Berkeley Lab., CA (United States). Dec 1991. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-920701–2: 10. international congress on catalysis, Budapest (Hungary), 19-24 Jul 1992). Order Number DE93000571. Source: OSTI; NTIS; GPO Dep.

An investigation has been carried out of the reaction pathway for the hydrodenitrogenation of quinoline over Mo_2N. Quinoline is found to undergo a rapid hydrogenation to form 1,2,3,4,-tetrahydroquinoline. This product then reacts more slowly to form 2-propylanaline, which in turn undergoes hydrogenolysis of the C-N bond in the saturated ring to form propylbenzene. No evidence is found for propylcyclohexane.

1172 (LBL–32408, pp. 259-262) **Analysis of forward and inverse problems in chemical dynamics and spectroscopy.** Rabitz, H. (Princeton Univ., NJ (United States)). Lawrence Berkeley Lab., CA (United States). [1992]. (CONF-9206180–Summs.: 14. combustion research meeting, Tahoe City, CA (United States), 14-17 Jun 1992). In *Fourteenth combustion research conference.* 347p. Order Number DE92017086. Source: OSTI; NTIS.

The goal of this research is to provide a better understanding of the relationship between structure in potential surfaces, and the behavior of resultant dynamical observables. This problem is being pursued from both the forward and inverse perspectives. In the case of forward analysis, one starts with a potential surface and proceeds to compute dynamical observables. In this case, the objective is to discern those parts of the potential surface that control significant dynamical events. In the case of inversion, the objective is to ultimately provide an algorithm for the stable inversion of quality laboratory data, to yield the underlying fundamental potential surfaces. The forward and inverse problems are intimately related, physically as well as operationally, though their common use of functional sensitivity analysis to map the forward and inverse observable $\Leftrightarrow$ potential relationships. The collinear $H + H_2$ exchange reaction was studied to explore how sensitivity information from one potential surface may be used to predict observables from a second surface. A detailed study of this type of this type was carried out for the laminar $CO\text{-}H_2\text{-}O_2$ flame under steady state conditions. The reactions of the hydroperoxy radical with hydrogen, oxygen, and hydroxy radicals were found to be extremely important at all temperatures in the fuel lean (40 torr) flame studied. A simulation of the full three-dimensional inversion for the He-Xe/C(0001) system was studied. Here, helium is being scattered from a xenon overlayer on graphite. The simulated inversion of ground state H_2 vibration-rotation spectral data was undertaken. The potential was recovered to high accuracy.

1173 (LBL–32473) **Spectroscopic and magnetic studies of tetravalent Pa and trivalent Th compounds.** Edelstein, N.M.; Kot, W.K. Lawrence Berkeley Lab., CA (United States). Jun 1992. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-920625–6: Conference on rare earths, Kyoto (Japan), 1-5 Jun 1992). Order Number DE92041214. Source: OSTI; NTIS; INIS; GPO Dep.

At the beginning of the actinide series, the 5f and 6d configurations are very close in energy. Consequently, both the 5f and 6d energy level splittings may be observed experimentally in Pa^{4+} and Th^{3+} compounds. The available magnetic and optical data on these systems are reviewed.

1174 (PNL-SA–21261) **Interactions between manganese oxides and multiple-ringed aromatic compounds.** Whelan, G. (Pacific Northwest Lab., Richland, WA (United States)); Sims, R.C. Pacific Northwest Lab., Richland, WA (United States). Aug 1992. 33p. Sponsored by USDOE, Washington, DC (United States); Geological Survey, Reston, VA (United States). DOE Contract AC06-76RL01830. Grant 14-08-0001-G1723. (CONF-9208152–1: ISSS working group meeting, Edmonton (Canada), 10-16 Aug 1992). Order Number DE92041342. Source: OSTI; NTIS; INIS; GPO Dep.

Objective is to determine whether Mn reductive dissolution can oxidize multiple-ringed aromatics, such as PAHs, in an oxic environment? Research indicated that certain PAHs (eg, dihydrodiols and diones that form free-radical intermediates) are susceptible to oxidation and polymerization. Over 14 days, 83, 76, 54, 70, and 20% of the Mn was reduced by 2,3-, 1,3-, and 1,4-naphthalenediol, quinizarin, and 1,4-naphthoquinone, respectively. 100, 100, and 65% of the first three PAHs were oxidized, respectively. Aromatics with diol functional groups were more easily oxidized than those with only dione groups. Relatively insoluble compounds like quinizarin can be oxidized; insoluble "humic-like" material precipitated, indicating a polymerization-humification process. Results suggest that electron transfer/organic release from the oxide surface is the rate-limiting step.

1175 (SAND–92-8623) **A theoretical study of the thermochemistry of molecules in the Si-C-Cl-H system.** Allendorf, M.D.; Melius, C.F. Sandia National Labs., Livermore, CA (United States). Oct 1992. 64p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DR00789. Order Number DE93002598. Source: OSTI; NTIS; GPO Dep.

Ab initio electronic structure calculations coupled with empirical corrections are used to obtain a self-consistent set of heats of formation for molecules in the series CH_nSiCl_m (n, m = 0–3) and for selected molecules in the series $(CH_3)_nSiH_mCl_p$, Heats of formation are also reported for the series $Cl_nSiSiCl_m$ (m,n = 0-3) and for $HC{\equiv}CSiCl_2H$ and $H_2C{=}CH(SiCl_2H)$. Gibbs free energies as a function of temperature and standard entropies are given for all molecules in the study. Heats of formation are used to evaluate potential pathways for the decomposition of Cl_3SiCH_3, a common silicon carbide chemical vapor deposition precursor. The analysis includes the calculation of the transition state for the 1,2-elimination of HCl from Cl_3SiCH_3.

1176 (SKB-TR–91-55) **Redox capacity of crystalline rocks. Laboratory studies under 100 bar oxygen gas pressure.** Pirhonen, V. (Technical Research Center of Finland, Esbo (Finland)); Pitkaenen, P. Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden). Dec 1991. 61p. Order Number DE93603184. Source: OSTI; NTIS; INIS.

The excess amount of dissolved oxygen has been used as a reducible species in order to determine reducing ability (redox capacity) of crystalline rocks and minerals in an aqueous granite solution. Both crushed and whole rock samples were used. The oxygen pressure was set to 100 bar both to promote diffusion and accelerate the surface reactions. The redox capacity was obtained as a function of the decrease of Fe (II) in the solid phase. The decrease of ferrous iron near the reaction surface ranged from about

2% up to 39%. All reacted samples showed a decrease of between 5-30% in the ratio of $FeII/Fe_{total}$ within a reaction zone at the rock surface. The reaction depth varied from about 0.1 cm up to more than 2.5 cm in rocks that were artificially ruptured and in naturally fractured granitic rocks, respectively. The redox capacity calculated from the average decrease of iron in profile varied from about 18 to 620 mol_{FeII}/m^3 and 320 to 580 mol_{FeII}/m^3 for the ruptured and the natural fracture samples, respectively. (6 refs., 4 figs., 5 tabs., 8 apps.) (au).

1177 (SKN–57) **Stability of metallic copper in the near surface environment.** Amcoff, Oe. (Uppsala Univ. (Sweden)); Holenyi, K. National Board for Spent Nuclear Fuel, Stockholm (Sweden). Mar 1992. 82p. Order Number DE93603185. Source: OSTI; NTIS; INIS.

The present study was initiated by the National Board for Spent Nuclear Fuel (SKN). It may be regarded as a review of the state of the art of copper stability - copper mobility in a low temperature - near surface environment. In the discussion, we have emphasized geological - geochemical milieus that have a direct bearing on the problem of final storage of spent nuclear fuel in copper canisters. The literature review has concentrated on copper in connection with: a. low-temperature environments, and b. Stability-mobility, with particular emphasis on a chloride-rich, sulphur-rich milieu. The possible influence on the present processes of radiolysis and engineered barriers besides copper is not discussed in this report. In order to faciliate the discussion, a number of examples on copper mineral stabilities and copper solubility etc. are given below, based on thermodynamic calculations. These calculations are simplified to a certain degree and the discussion is based on differences in orders of magnitude rather than on exact figures. The thermodynamic foundation for the calculations is given in an appendix. Conclusions and recommendations are outlined in general terms in a separate report. (59 refs.) (au).

1178 (STRIPA-TR–92-23) **Theoretical investigations of grout seal longevity - Final report.** Alcorn, S. (RE/SPEC Inc., Albuquerque, NM (United States)); Coons, W.; Christian-Frear, T.; Wallace, M. Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden). Apr 1992. 90p. Order Number DE93603186. Source: OSTI; NTIS; INIS.

Theoretical investigations into the longevity of repository seals have dealt primarily with the development of a methodology to evaluate interactions between portland cement-based grout and groundwater. Evaluation of chemical thermodynamic equilibria between grout and groundwater, and among grout, groundwater, and granitic host rock phases using the geochemical codes EQ3NR/EQ6 suggests that a fracture filled with grout and saturated with groundwater will tend to fill and 'tighten' with time. Results of these investigations suggest that cement grout seals will maintain an acceptable level of performance for tens of thousands to millions of years, provided the repository is sited where groundwater chemistry is compatible with the seals and hydrologic gradients are low. The results of the grout: groundwater: rock calculations suggest that buffering of the fracture seals chemical systems by the granite rock may be important in determining the long-term fate of grout seals and the resulting phase assemblage in the fracture. The similarity of the modelled reaction products to those observed in naturally filled fractures suggests that with time equilibrium will be approached and grouted fractures subject to low hydrologic gradients will continue to seal. If grout injected into fractures materially reduces groundwater flux, the approach to chemical equilibrium will likely be accelerated. In light of this, even very thin or imperfectly grouted fractures would tighten in suitable hydrogeologic environments. (29 refs.) (au).

1179 (WSRC-MS–92-332) **Adsorption of a binary gas mixture which laterally interacts on a random heterogeneous surface.** Ritter, J.A. Westinghouse Savannah River Co., Aiken, SC (United States). [1992]. 26p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. (CONF-921104–5: American Institute of Chemical Engineers annual meeting, Miami, FL (United States), 1-6 Nov 1992). Order Number DE93000706. Source: OSTI; NTIS; GPO Dep.

Analytical expressions for the adsorption of a binary gas mixture which laterally interacts on a heterogeneous surface are developed. The lateral interactions are of the Bragg-Williams type and the surface heterogeneity is modeled via a random distribution of sites described by a uniform distribution of Henry's Law constants. The parametric study shows that complex phase behavior can be predicted, including azeotropes and sigmoidal shaped X-Y diagrams. Also, this model may be useful for modeling and designing adsorption processes as it requires few iterations to simultaneously solve the implicit and coupled algebraic expressions.

4004 Electrochemistry

Refer also to citation(s) 974, 1146

1180 (BNL–47591) **The chemical potential from extrinsic ions in oxide films on aluminum.** Isaacs, H.S.; Davenport, A.J. Brookhaven National Lab., Upton, NY (United States). [1992]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-89ER45384 ;AC02-76CH00016. (CONF-921036–6: 182. meeting of the Electrochemical Society, Toronto (Canada), 11-16 Oct 1992). Order Number DE92041313. Source: OSTI; NTIS; GPO Dep.

X-ray studies of Cr in Al oxide films have shown that 3- and 6-valent Cr may be present. 300 nm Al films were anodized, cathodized or exposed to $K_3Cr(CN)_6$, $NaMoO_4$, $KMnO_4$, or $NaVO_3$ solutions. Cathodized surfaces were then anodized in borate solution. X-ray absorption at glancing angle and fluorescence detection were used to study species incorporated in the oxide surface. The 3-valent Cr present was closely related to $Cr(OH)_3$. Absence of a pre-edge peak associated with the 6-valent Cr shows that conditions at the oxide surface did not produce chromates. $Cr(CN)_6^{3-}$ complex is not strongly absorbed on the surface, in contrast to chromates. The permanganate and vanadate solutions gave only 4-valent Mn and 5-valent V. The effective oxidation potential inside the oxide film is estimated. 11 refs., 2 figs., 2 tabs. (DLC)

1181 (LBL–32728) **Development and application of the quasi-potential transformation.** Pillay, B. Lawrence Berkeley Lab., CA (United States). Aug 1992. 82p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. Order Number DE93000580. Source: OSTI; NTIS; GPO Dep.

The quasi-potential transformation, based on the Kirchhoff transformation, reduces the equations governing mass-transfer in a steady-state, nonconvective electrolytic system into two independent parts. The geometry-specific part involves the solution of Laplace's equation subject to the relevant boundary conditions. The system-specific part involves the solution of a set of coupled first-order, nonlinear, ordinary differential equations. We develop a theoretical basis for the quasi-potential transformation using potential theory. The major assumption on which the quasi-potential transformation is based is that the concentrations can be written as single-valued functions of the electrostatic potential. We see how the system-specific part of the calculation is developed. Boundary conditions are outlined, and the geometry-specific calculations for the disk and hemisphere electrodes are developed. We combine the system-specific calculations for the binary and acidic copper sulfate solutions with these geometry-specific calculations to obtain complete concentration profiles, potential distributions, and current density distributions for these systems. We also investigate the effect of migration on limiting currents.

4005 Photochemistry

Refer also to citation(s) 368, 1154, 2084, 2162

1182 (ANL/CP–76566) **Supramolecular structures modeling photosynthetic reaction center function.** Wasielewski, M.R.; Gaines, G.L. III; Gosztola, D.; Niemczyk, M.P.; Svec, W.A. Argonne National Lab., IL (United States). 20 Aug 1992. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9208155–1: 9. international congress on photosynthesis, Nagoya (Japan), 30 Aug - 5 sep 1992). Order Number DE92041123. Source: OSTI; NTIS; GPO Dep.

Work in our laboratory has focused on the influence of solvent motion on the rates and energetics of photochemical charge separation in glassy solids. The efficiencies of many nonadiabatic electron transfer reactions involving photochemical electron donors with relatively low excited state energies, such as porphyrins and chlorophylls, are poor in the solid state. Recent work has shown that placing a porphyrin-acceptor system in a glassy solid at low temperature significantly raises the energy of ks ion-pair state. This destabilization can be as much as 0.8 eV relative to the ion pair state energy in a polar liquid. This contrasts sharply with photosynthetic reaction centers, which maintain medium-independent electron transfer rates with relatively small free energies of charge separation. Using this information we have set out to design photochemical systems that produce long-lived radical ion pairs in glassy solids with high quantum efficiency. These systems maintain their efficiency when placed in other glassy matrices, such as polymers. An important consequence of this effort is the design of molecules that minimize the electronic interaction between the oxidized donor and reduced acceptor. This minimization can be attained by careful design of the spacer groups linking the donor and acceptor and by using more than a single electron transfer step to increase the distance between the separated charges as is done in natural photosynthesis.

1183 (DOE/ER/13227–T4) **Pulsed laser kinetic studies of liquids under high pressure: Progress report, November 25, 1991–September 18, 1992.** Eyring, E.M. Utah Univ., Salt Lake City, UT (United States). 22 Sep 1992. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-84ER13227. Order Number DE93000884. Source: OSTI; NTIS; GPO Dep.

A laser flash photolysis kinetic study of 2,2′-bipyridine bidentate chelating ligands with one claw in the first coordination sphere of a molybdenum carbonyl complex has been completed at pressures up to 150 MPa. The reaction mechanism for thermal ring closure is found from activation volumes to change from associative interchange to dissociative interchange as substituents on the 2,2′-bipyridine ligands become bulkier. In a similar study of more rigid, substituted phenanthroline bidentate ligands it was found that substituent bulkiness had little effect on the thermal ring closure mechanism. Stability constants for lithium ion complexes with crown ethers in a room temperature molten salt, fluorescence quantum yields for cresyl violet and several other dyes in solution, and the oxidation of alcohols by OsO_4 have also been investigated.

1184 (DOE/ER/13603–6) **Study of intermediates from transition metal excited-state electron-transfer reactions: [Annual] progress report, August 1, 1989–July 31, 1992.** Hoffman, M.Z. Boston Univ., MA (United States). Dept. of Chemistry. 31 Jul 1992. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-86ER13603. Order Number DE93001681. Source: OSTI; NTIS; GPO Dep.

Conventional and fast-kinetics techniques of photochemistry, photophysics, radiation chemistry, and electrochemistry were used to study the intermediates involved in transition metal excited-state electron-transfer reactions. These intermediates were excited state of Ru(II) and Cr(III) photosensitizers, their reduced forms, and species formed in reactions of redox quenchers and electron-transfer agents. Of particular concern was the back electron-transfer reaction between the geminate pair formed in the redox quenching of the photosensitizers, and the dependence of its rate on solution medium and temperature in competition with transformation and cage escape processes. (DLC)

1185 (DOE/ER/13629–6) **Photophysics and photoredox processes at liquid-liquid interfaces: Progress report, April 1, 1990–September 1992.** Webber, S.E. Texas Univ., Austin, TX (United States). Dept. of Chemistry and Biochemistry. Sep 1992. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-86ER13629. Order Number DE93001841. Source: OSTI; NTIS; GPO Dep.

This report is divided into four sections: (1) Recent work on polymers with covalently bound chromophores, primarily involving triplet state electron transfer quenching; (2) Pyrene and pyrene butyric acid adsorbed onto polystyrene latexes (microspheres); (3) Adsorption and micellization of amphiphilic block polymers with chromophores at the junction between the hydrophobic and hydrophilic part; (4) Adsorption of alternating polymers with grafted "combs" to improve adsorption onto a hydrophobic surface.

4006 Radiation Chemistry

Refer also to citation(s) 1154, 1193

1186 (DOE/ER/13404–7) **The contribution of electronically excited states to the radiation chemistry of organic systems: Progress report, January 1, 1991–April 30, 1992.** Lipsky, S. Minnesota Univ., Minneapolis, MN (United States). Dept. of Chemistry. [1992]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-85ER13404. Order Number DE92040465. Source: OSTI; NTIS; GPO Dep.

At low concentrations ($\leq 10^{-3}$M) of aromatic solutes in saturated. hydrocarbon solvents, very efficient transport of electronic energy from photo-excited solvent to aromatic is observed. Effects of temperature, dilution, and quenching additives are being studied. Two-photon pulsed laser excitation gives no evidence of long lived metastable states. The fluorescence quantum yields of saturated hydrocarbon liquids have been studied for excitation wavelengths from 200 to 120 nm. For many compounds, the quantum yields for fluorescence are observed to decline to a minimum value at, or near, previously reported ionization thresholds. At higher energies, the magnitude of the quantum yield for fluorescence begins to increase. Magnetic field effects on intensity of steady-state recombination fluorescence have been observed both for photo-generated and B^- generated, electron and positive ion geminate pairs in saturated hydrocarbon liquids. The comparison indicates an important contribution . to observed recombination fluorescence from multiple ion-pairs under radiation chemical conditions. For photo-excited aromatic solutes dissolved in saturated hydrocarbon liquids, no magnetic field effect could be observed until surprisingly large excess energies above the threshold for ionization were achieved. This suggests a much smaller average range for the thermalized electron than expected from photoconductivity.

1187 (FRCEA-TH–370) **Study of unstable valences of cadmium and samarium by pulse radiolysis. Influence of complexation by some synthetical ionophores.** Lerat-Parizot, O. CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Direction des Sciences de la Matiere; Paris-11 Univ., 91 - Orsay (France). 16 Jun 1992. 196p. (In French). Order Number DE93721138. Source: OSTI; NTIS (US Sales Only); INIS.

Instable valences of cations in solution are evidenced by pulse radiolysis, in spite of a lifetime often lower than a milli-second they participate to electron transfer reactions, owing to their redox potential. In this work are studied Cd^+ and Sm^{2+} obtained respectively by reduction of Cd^{2+} and Sm^{3+} by a solvated electron. The reactivity of Cd^+ in a cryptand and in a coronand is studied; it is a powerful reducing agent (redox potential -2V) going back to the stable valence by electron transfer to an acceptor. Transfer kinetics is studied by reduction of organic molecules, effect of solvents and ligands is also examined. For samarium the reduction kinetics by hydrated electrons is increased when the ion is in a cryptand in agreement with electrochemical observations, showing that the valence 2+ is stabilized in respect to the valence 3+ for lanthanides. The difference of behaviour between Cd^+ and Sm^{2+} is probably due to the fact that for Cd the transferred electron comes from the external layer and for Sm it is a f electron protected by the 5s and 5p orbitals.

4007 Radiochemistry and Nuclear Chemistry

Refer also to citation(s) 158, 186, 619

1188 (BARC–1991/E/022) **Removal of cesium from low level waste solutions by copper hexacyanoferrate loaded resins.** Singh, I.J. (Bhabha Atomic Research Centre, Bombay (India). Process Engineering and Systems Div.); Ramaswamy, M. Bhabha Atomic Research Centre, Bombay (India). 1991. 18p. Order Number DE93605220. Source: OSTI; NTIS (US Sales Only); INIS.

Sorbents for the separation of radio cesium from aqueous solutions were synthesized by incorporating copper hexacyanoferrate

(II) in the matrix of anion exchange resins of Indian origin, viz. Indion-810 and Tulsion-A27MP. Their efficiency for the cesium removal was tested under both static and dynamic conditions. The resins were found to be highly selective for radio cesium from a variety of salt and acid solutions. In general, Tulsion-based resins showed more tolerance towards chemical load in the solutions than the other. Pilot column run with Indion-based loaded resin showed that it effectively removed all the cesium activity from few thousands of litres of mixed low level waste streams from reactors, fuel reprocessing plant and nuclear laboratories. (author). 24 refs., 2 figs., 3 tabs.

1189 (CEA-CONF–10978) **Extraction of actinides from chloride medium using pentaalkylpropanediamides.** Cuillerdier, C.; Musikas, C. CEA Centre d'Etudes de la Vallee du Rhone, 30 - Marcoule (France). Dept. des Procedes de Retraitement. 1991. 14p. (CONF-911049–: 7. symposium on separation science and technology for energy applications, Knoxville, TN (United States), 20-24 Oct 1991). Order Number DE93721040. Source: OSTI; NTIS (US Sales Only); INIS.

Pyrometallurgical processes for the purification of plutonium create waste solutions containing actinides, mainly americium, in chloride medium. Studies have been undertaken to study the extraction of actinides in chloride medium (hydrochloric acid mixed with concentrated salts such as LiCl, $CaCl_2$, $MgCl_2$, KCl) using pentaalkylpropanediamides as extractants. Plutonium (IV) is very easily extracted, Am (III) needs a salting out agent such as LiCl. Back extraction of trivalent cations is easy in HCl <5M. Plutonium(IV) and (VI) can be stripped by reduction either with ascorbic acid or hydroxylammonium salts in weak acid medium. Several diluents can be used (aromatic, chlorinated or even aliphatic) with addition of decanol to prevent third phase formation. In conclusion diamides can be used for various wastes declassification, they are potentially completely incinerable, and, as the synthesis has been optimized, they appear to be promising extractants.

1190 (CEAC-R–1-92) **Obtention of thin depositions by the vacuum evaporation technique.** Gonzalez Mateu, D. (Centro de Estudios Aplicados al Desarrollo Nuclear (CEADEN), La Habana (Cuba)); Labrada, A.; Voronin, A. Comision de Energia Atomica, La Habana (Cuba). 1991 9p. (In Spanish). Order Number DE93603199. Source: OSTI; NTIS (US Sales Only); INIS.

The vacuum evaporating technique used to prepare thin depositions, and the technical characteristics of the constructed installation are described. ^{235}U y ^{238}U nuclear target for the fission researches were obtained. Aluminium and gold self-supporting foils were obtained too.

1191 (FRCEA-TH–371) **Synthesis and reactivity of triscyclopentadienyl uranium (III) and (IV) complexes.** Berthet, J.C. CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Direction des Sciences de la Matiere; Paris-11 Univ., 91 - Orsay (France). 15 Jun 1992. 257p. (In French). Order Number DE93721137. Source: OSTI; NTIS (US Sales Only); INIS.

The reactions of $(RC_5H_4)_3U$ with R=trimethylsilylcyclopentadienyl or tertiobutylcyclopentadienyl are studied for the synthesis of new uranium organometallic compounds. Reactions with sodium hydride are first described uranium (III) anionic hydrides obtained are oxidized for synthesis of stable uranium (IV) organometallic hydrides. Stability of these compounds is discussed. Reactivity of these uranium (III) and (IV) hydrides are studied. Formation of new binuclear compounds with strong U-O and U-N bonds is examined and crystal structure are presented. Monocyclooctatetraenylic uranium complexes are also investigated.

1192 (IGC–126) **Radiochemistry programme : biennial progress report (1988 - 1989).** Indira Gandhi Centre for Atomic Research, Kalpakkam (India). 1991. 159p. Order Number DE93605214. Source: OSTI; NTIS (US Sales Only); INIS.

The Research and Development activities of the Radiochemistry Division of Indira Gandhi Centre for Atomic Research, Kalpakkam during the period 1988-89 are desribed in the form of summaries. The main thrust of R and D activities is on fast breeder reactor technology. The summarises are arranged under the headings : (1) Chemistry of Liquid Alkali Metals, (2) High Temperature Chemistry of Advanced Materials, (3) Chemistry of Nuclear Fuel Reprocessing, (4) Post-Irradiation analysis and Nuclear Chemistry, (5) Analytical Characterisation of Materials, (6) Analytical Services and (7) Instrumentation and Mechanical Services. At the end, a list of publications by scientists of the Division published during the report period is given. The list includes papers published in journals, papers presented at various symposia, conferences etc, and technical reports. (author). tabs., figs.

1193 (INFO–0364) **Properties of unattached polonium-218 in the propylene-nitrogen gas system.** Phillips, C.R. (Chemical Engineering Research Consultants Limited (Canada)). Atomic Energy Control Board, Ottawa, ON (Canada). Oct 1988. 25p. Project 4.123.1. Order Number DE93603197. Source: OSTI; NTIS (US Sales Only); INIS.

Electrostatic and diffusion properties of unattached polonium 218 were investigated in a propylene-nitrogen gas system. The diffusion coefficient of neutral unattached polonium 218 under various relative humidities was measured and was found to be lowered by humidity owing to the formation of clusters. The fraction of polonium 218 having a positive charge at a gas age of about 0.1 second was determined. The mobility of the charged polonium 218 was obtained independently by using a pulse width modulated ion mobility analyzer, which employed the time of flight method. The diffusion coefficient and mobility data obtained fitted the Einstein equation on the assumption that the polonium 218 ion has one positive charge. The neutralization rate constant of polonium 218 ions under various relative humidities and radon concentrations was investigated, and three neutralization mechanisms were observed. The neutralization rate constant is proportional to the 0.2 power of the radon concentration at all relative humidities, suggesting that the small ion recombination mechanism plays an important role. The charge transfer mechanism involving propylene and polonium hydroxide ions is responsible for lowering the power dependence of the neutralization rate constant on radon concentration from 0.5 (in nitrogen) to 0.2 (in propylene-nitrogen). The presence of the electron scavenging mechanism involving hydroxyl groups formed from water vapour radiolysis causes the neutralization rate constant to increase with relative humidity. (12 refs., 3 figs., 5 tabs.).

1194 (INIS-BR–2939, pp. 57) **Synthesis and isolation of d,1-HMPAO for preparation of radiopharmaceutical with technetium 99m for medical use.** Muradian, J. (Sao Paulo Univ., SP (Brazil). Inst. de Quimica); Marques, F.L.N. Colegio Brasileiro de Radiologia, Sao Paulo, SP (Brazil). 1991. 232p. (In Portuguese). (CONF-9104394–: 5. Latin American Congress of Ultrasound in Medicine and Biology; Seminar of the Inter American College of Radiology, Sao Paulo (Brazil), 14-17 Apr 1991). In *Proceedings of the 5. Latin American Congress of Ultrasound in Medicine and Biology; Seminar of the Inter American College of Radiology - Abstracts.* Order Number DE93603710. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. OXIMES/chemical preparation; OXIMES/technetium 99; TECHNETIUM 99/pertechnetates; TECHNETIUM 99/radiopharmaceuticals; AMINES; METHYL RADICALS; OXIMES; PROPYLENE; SODIUM COMPOUNDS; PERTECHNETATES; RADIOPHARMACEUTICALS

1195 (INIS-BR–2939, pp. 58) **Production of lyophilized kits for labelling d,1-HMPAO with technetium-99m.** Rockmann, T.M.B. (Sao Paulo Univ., SP (Brazil). Centro de Medicina Nuclear); Muradian, J.; Marques, F.L.N.; Coelho, I.J.C.; Moraes, D.W.; Buchpiguel, C.A.; Martin, D.W. de; Camargo, E.E.; Dias Neto, A.L. Colegio Brasileiro de Radiologia, Sao Paulo, SP (Brazil). 1991. 232p. (In Portuguese, English). (CONF-9104394–: 5. Latin American Congress of Ultrasound in Medicine and Biology; Seminar of the Inter American College of Radiology, Sao Paulo (Brazil), 14-17 Apr 1991). In *Proceedings of the 5. Latin American Congress of Ultrasound in Medicine and Biology; Seminar of the Inter American College of Radiology - Abstracts.* Order Number DE93603710. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. OXIMES/chemical preparation; OXIMES/technetium 99; TECHNETIUM 99/pertechnetates; AMINES; BRAIN; METHYL RADICALS; OXIMES; PROPYLENE; QUALITY CONTROL; RADIOPHARMACEUTICALS; SODIUM COMPOUNDS; SOLVENT EXTRACTION; PERTECHNETATES; TOMOGRAPHY

1196 (KAERI/RR–1029/91) **A study on ion separation through liquid membrane.** Kang, Young Ho (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Kwon, Sun Kil; Joo, Jae Oh; Whang, Sung Chan; Kim, Jung Do; Ann, Hyun Suk. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Dec 1991. 61p. (In Korean). Order Number DE93605215. Source: OSTI; NTIS (US Sales Only); INIS.

The flux of uranyl nitrate across cellulose acetate was determined using TOPO as a carrier. TOPO particles were physically entrapped in the membrane, which prepared by phase inversion method. The dominating factors were the amount of plasticizer, CTA-TOPO ratio in the membrane, uranium concentration in the feed solution, acidity and the solution temperature. And the transport phenomena of uranyl nitrate across this membrane were microscopically analysed by SEM. The increase of the membrane stability was observed when TOPO was used as a carrier. Another new technology to economically reduce the low-level liquid waste through the membrane is tested in a laboratory scale. (Author).

1197 (KAERI/RR–1091/91) **Production of cyclotron radionuclides.** Lee, Jong Doo (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Jeon, Kwon Soo; Yang, Seong Dae; Seo, Yang Sup; Chae, Jong Seo; Yoon, Yong Ki; Park, Hyun; Koo, Young Yoon. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Feb 1992. 21p. (In Korean). Order Number DE93605221. Source: OSTI; NTIS (US Sales Only); INIS.

In the project, 563mCi of Ga-67 and 45mCi of Tl-201 were supplied, the mass production method of Ga-67 was established by using enriched Zn-68 target material and 449mCi of I-123 was produced for the biological application. For the promotion of RI sale, the legal basis was arranged and the supply system was reorganized. For the efficient use of the cyclotron, the MC-50 cyclotron was opened to outside users and three basic research projects were carried out. The technical supports and radionuclides analysis were done during the execution of the research projects. And, the target cooling system and RI handling techniques accompanying for radioisotope production were improved. (Author).

1198 (KAERI/RR–1102/91) **Studies on the preparation of labelled compounds for γ-scintigraphy use.** Park, Kyung Bae (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Kim, Jae Rok; Awh, Ok Doo; Sin, Byung Cheul; Park, Woong Woo; Han, Kwang Hee. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Mar 1992. 45p. (In Korean). Order Number DE93605222. Source: OSTI; NTIS (US Sales Only); INIS.

1. ^{165}Dy-HMA for treating rheumatoid arthritis 1) Irradiation of 12 mg $^{164}Dy_2O_3$ showing specific activity (SA)of $2x10^{13}$ n/cm^{2}s for 4 h gave $^{165}Dy_2O_3$ showing SA≈480 mCi/mg and radionuclidic purity >99.9%. 2) ^{165}Dy-HMA was prepared in yield of 80-85% from $^{165}DyCl_3$ solution made by dissolving $^{165}Dy_2O_3$ with HCl and adjusting pH to 3.0, and then followed by the treatment with aq NaOH solution. 3) Serial filtration using polycarbonate filter (1-10μm) of ^{165}Dy-HMA suspension in saline after treatment with sonificator exhibited majority of particles in the 3-8μm range. 4) Even though the ^{165}Dy-HMA suspension in saline was left to stand for 24 h at room temperature, there was no significant change in particle size resulting in high stability of ^{165}Dy-HMA. 2. Study on the 99mTc labelling of bioactive material 1) The labelling of antibody [F(ab')$_2$] coupled to DTPA with Na99mTcO$_4$ in the presence of Na dithionite(μg) gave labelling yield of 40% determined by ITLC-SG. 2) The labelling of 500μl of antibody solution in phosphate buffer(0.2M, pH 7.4, 1.5mg antibody/ml) with $Na^{131}I$(3-5mCi) in the presence of chloramine-T(0.14mg) for 30 min at room temperature exibited labelling yield of 60-70%, radiochemical purity of 97%, specific activity of 1.2-3.5 mCi/mg, respectively, determined by ITLC-SG. 3) Results obtained from the animal experiment in rabbit to study the specificity and sensitivity of ^{131}I labelled antibody exhibited hot uptake until 72 h in the case of tuberculous infection, with the highest target/background ratio(2.52) at 24 h after injection of ^{131}I-F(ab')$_2$ 4) In the case of rabbit infected with syphilitic orchitis, it exhibited the highest target/background ratio(3.51) at 2 h after injection and showed fast decrease.

4008 Combustion, Pyrolysis, and High-Temperature Chemistry

Refer also to citation(s) 1172, 1175

1199 (ANL/CP–77468) **Incineration of toluene and chlorobenzene in a laboratory incinerator.** Mao, Z.; Mcintosh, M.J.; Demirgian, J.C. Argonne National Lab., IL (United States). [1992]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9209160–12: International symposium on energy, environment and information management, Argonne, IL (United States), 15-18 Sep 1992). Order Number DE92041089. Source: OSTI; NTIS; INIS; GPO Dep.

This paper reports experimental results on the incineration of toluene and chlorobenzene in a small laboratory incinerator. Temperature of the incinerator, excess air ratio and mean residence time were varied to simulate both complete and incomplete combustion conditions. The flue gas was monitored on line using Fourier transform infrared (FTIR) spectroscopy coupling with a heated long path cell (LPC). Methane, toluene, benzene, chlorobenzene, hydrogen chloride and carbon monoxide in the flue gas were simultaneously analyzed. Experimental results indicate that benzene is a major product of incomplete combustion (PIC) besides carbon monoxide in the incineration of toluene and chlorobenzene, and is very sensitive to combustion conditions. This suggests that benzene is a target analyle to be monitored in full-scale incinerators.

1200 (DOE/ER/13878–4) **[Homogeneous-heterogeneous combustion: Thermal and chemical coupling]: [Annual report] research in progress.** Minnesota Univ., Minneapolis, MN (United States). Jan 1992. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-88ER13878. Order Number DE93002881. Source: OSTI; NTIS; GPO Dep.

This is a program to characterize fundamental issues and practical applications of homogeneous-heterogeneous reactions. Fundamental studies of reactions at low pressures and of boundary layer characterization give microscopic information on the processes. Ignition and extinction studies over simple geometries give basic bifurcation behavior with which to characterize multiple steady states and their stabilities and hopefully to identify the types of behavior which may occur. Use of catalytic monoliths will permit examination of the chemical and thermal performance of one of the most important types of geometries in which both types of reaction can occur. Modeling will tie all of these aspects together by showing how individual components interact, Predicting performance of monoliths, and providing the framework for translating these ideas into technological contexts.

42 ENGINEERING

1201 (DOE/ER/13572–3) **Linear oscillations of a drop in uniform alternating electric fields: [Annual report, 1989].** Yang, Wenrui; Carleson, T.E. Idaho Univ., Moscow, ID (United States). Dept. of Chemical Engineering. Oct 1990. 24p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG07-86ER13572. (CONF-901155–8: American Institute of Chemical Engineers (AIChE) fall annual meeting, Chicago, IL (United States), 11-16 Nov 1990). Order Number DE92040895. Source: OSTI; NTIS; GPO Dep.

Oscillations of a conducting drop immersed in a dielectric fluid in an alternating electric field has been modelled in order to understand the enhancement of the transport processes by the electric field. Numerical solutions for oscillation amplitude, velocity distribution, resonant frequency and streamlines were obtained. The effects of viscosity and density on the resonant frequency and the velocity distribution were investigated. It was found that the resonant frequency of viscous fluids was always smaller than the free oscillation frequency of the same droplet. The predicted scanning frequency response curve and the streamlines agree well with the experimental observations.

4202 Facilities, Equipment, and Techniques

Refer also to citation(s) 215, 278, 492, 869, 870, 984, 1021, 1089, 1129, 1130, 1140, 2475

1202 (CONF-9202137–1) **Mobile manipulator configuration optimization using evolutionary programming.** McDonnell, J.R. (Naval Command, Control and Ocean Surveillance Center, San Diego, CA (United States)); Andersen, B.L.; Page, W.C.; Pin, F.G. Oak Ridge National Lab., TN (United States). [1992]. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 1. annual conference on evolutionary programming; La Jolla, CA (United States); 21-22 Feb 1992. Order Number DE92041307. Source: OSTI; NTIS; GPO Dep.

Multi-degree-of-freedom manipulators are becoming commonplace on mobile platforms. Full autonomy of mobile manipulator robotic systems will depend on the ability to resolve the inherent kinematic redundancy in task commutation. This work investigates the application of an evolutionary search strategy for determining near-optimal mobile manipulator configurations. Joint torques, obstacle avoidance and manipulability are incorporated in a multi-criteria optimization formulation. A variety of aspects of the evolutionary programming paradigm are addressed via empirical studies on a two degree-of-freedom (DOF) manipulator. These studies investigate full configuration vector versus partial configuration vector mutation as well as mutation strategies which incorporate cost and iteration number. The results of this study are then applied to a planar three DOF manipulator mounted on a single DOF mobile base. Experiments indicate that the configuration optimization problem is amenable to a variety of mutation strategies.

1203 (CONF-920905–19) **A revision of the Cask Designers Guide for the '90s.** Shappert, L.B.; Green, V.M. Oak Ridge National Lab., TN (United States). [1992]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 10. international symposium on the packaging and transportation of radioactive materials: PATRAM '92; Yokohama (Japan); 13-18 Sep 1992. Order Number DE92041254. Source: OSTI; NTIS; INIS; GPO Dep.

The report A Guide for the Design Fabrication, and Operation of Shipping Casks for Nuclear Applications, ORNL-NSIC-68, commonly called the Cask Designers Guide, is being revised at the request of the Transportation and Packaging Safety Division of the Department of Energy (DOE). The new document will be called the Packaging Handbook. The Cask Designers Guide was published in 1970 during the period when many radioactive materials packagings were being developed and many technical studies applicable to these packagings were being performed. Since that period, many improvements in packaging design have appeared, designers have improved their calculational techniques, and much effort has gone into applying Quality Assurance (QA) principles to cask development Materials, and their limitations, have surfaced as a very important consideration in the licensing process. While the Packaging Handbook considers all Type B packages, most of the authors' experience lies in the technical areas found in the licensing of spent nuclear fuel (SNF) packagings and this is reflected in the document.

1204 (CONF-920905–20) **Drop testing of the Westinghouse fresh nuclear fuel package.** Shappert, L.B. (Oak Ridge National Lab., TN (United States)); Sanders, C.F. Oak Ridge National Lab., TN (United States). [1992]. 9p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC05-84OR21400. From 10. international symposium on the packaging and transportation of radioactive materials: PATRAM '92; Yokohama (Japan); 13-18 Sep 1992. Order Number DE92041255. Source: OSTI; NTIS; INIS; GPO Dep.

In recent years, the Westinghouse Columbia Fuel Fabrication Facility has been faced with increasing pressure from utilities that wished to take the fuel in their nuclear power plants to higher burnups. To help accommodate this trend, Westinghouse has determined that it needs the ability to increase the enrichment of the fresh fuel it delivers to its customers. One critical step in this process is to certify a new (Type A, fissile) fresh fuel package design that has the capability to transport fuel with a higher enrichment than was previously available. A prototype package was tested in support of the Safety Analysis Report of the Packaging. This paper provides detailed information on those tests and their results.

1205 (CONF-9210168–1) **Sensor-based whole-arm obstacle avoidance for unstructured environments.** Wintenberg, A.L.; Butler, P.L.; Babcock, S.M.; Ericson, M.N.; Armstrong, G.A.; Britton, C.L. Jr.; Hamel, W.R. Oak Ridge National Lab., TN (United States). [1992]. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 1992 American Nuclear Society (ANS) international conference; Chicago, IL (United States); 15-20 Oct 1992. Order Number DE92041265. Source: OSTI; NTIS; INIS; GPO Dep.

Whole-arm obstacle avoidance is needed for a variety of robotic applications in the Environmental Restoration and Waste Management (ER&WM) Program. Typical industrial applications of robotics involve well-defined workspaces, allowing a predetermined knowledge of collision-free paths for manipulator motion. However, many hazardous environments are unstructured or poorly defined, providing a significant potential for collisions between manipulators and the environment. In order to allow applications of robotics in such situations, a sensing system is under development which will provide protection against collisions. Specifics of this system including system architecture and projected implementation are described.

1206 (DPW–5411) **Charging crane tests: Minutes of meeting.** Carleton, J.T. Du Pont de Nemours (E.I.) and Co., Wilmington, DE (United States). 16 May 1952. 2p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-76SR00001. (SR/H–225). Order Number DE93001458. Source: OSTI; NTIS (US Sales Only); GPO Dep.

A meeting was held on May 6, 1952 to discuss tests to be carried out on the charging crane assembly in the Brooklyn shop of the American Machine and Foundry Co. (JL)

1207 (DPW–5520) **Project 8980: Savannah River Plant, 200 Area, 221 Building: Excerpts from Hanford reports, September to December 1951, TBP, UO_3 and Redox plants.** Moore, P.R. Du Pont de Nemours (E.I.) and Co., Wilmington, DE (United States). Explosives Dept. 2 Jun 1952. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-76SR00001. (SR/H–236). Order Number DE93001913. Source: OSTI; NTIS (US Sales Only); GPO Dep.

We report herewith for your information certain items abstracted from the monthly reports of Hanford Works in regard to problems encountered during recent construction and start-up of new facilities. This report is dated June 2, 1952. (JL)

1208 (ETDE-IT–92-80) **Calculation of impulse current distributions and magnetic fields in lightning protection structures: Computer program laboratory validation.** Cortina, R.; Porrino, A. Ente Nazionale per l'Energia Elettrica, Milan (Italy). Centro di Ricerca Elettrica. 1991. 6p. Order Number DE93729441. Source: OSTI; NTIS (US Sales Only).

A circuital model and an ad-hoc computer program were set up to evaluate electromagnetic interference in the vicinity of protective structures struck by lightning. This program permits the evaluation of the impulsive magnetic fields by calculating the impulse current distribution in the different parts of such structures. It allows also the evaluation of the electromagnetic interference induced on susceptible victim circuits to which electric equipment may be connected. To validate the approach, a series of impulse tests were performed in the laboratory on conductive structures conceived to highlight the features of the program and to put into evidence the dependence of the impulse current distributions on some particular phenomena that need simplified modelling, e.g., the effect of induced or return currents through the ground.

1209 (EUR–14363) **Practical decommissioning experience with nuclear installations in the European Community.** Skupinski, E. (Commission of the European Communities, Brussels (Belgium)). Commission of the European Communities, Luxembourg (Luxembourg). 1992. 207p. (CONF-9109441–: 2. Seminar on practical decommissioning experience with nuclear installations in the European Community, Sellafield (United Kingdom), 25-26 Sep 1991). Source: OSTI; NTIS (US Sales Only); INIS.

Initiated by the Commission of the European Communities (CEC), this seminar was jointly organized by the AEA, BNFL and the CEC at Windermere and the sites of Windscale/Sellafield, where the former Windscale advanced gas-cooled reactor and the Windscale piles are currently being dismantled. The meeting aimed at gathering a limited number of European experts for the presentation and discussion of operations, results and conclusions on techniques and procedures currently applied in the dismantling of large scale nuclear installations in the European Community.

1210 (EUR–14363, pp. 95-110) **Recent decommissioning experience in BNFL.** Buck, S. (British Nuclear Fuels plc, Sellafield (United Kingdom)); Challinor, S.F. Commission of the European Communities, Luxembourg (Luxembourg). 1992. (CONF-9109441–: 2. Seminar on practical decommissioning experience with nuclear installations in the European Community, Sellafield (United Kingdom), 25-26 Sep 1991). In *Practical decommissioning experience with nuclear installations in the European Community.* 207p. Order Number DE93721081. Source: OSTI; NTIS (US Sales Only); INIS.

BNFL is now engaged in a long term programme to decommission surplus radioactive facilities. Certain projects have been deliberately selected to provide experience in decommissioning specific types of facilities whilst all have proven invaluable training grounds in decommissioning techniques and organisation. Four projects are included here, selected for the lessons and experience they have provided. These are the original Sellafield Fuel Storage Pond, a mixed oxide (Pu+U) fuel plant, redundant plutonium facilities within the main Magnox reprocessing plant, and the Capenhurst Gaseous Diffusion Uranium enrichment plant.

1211 (INIS-BR–2933, pp. 297) **Installation and initial activities of Magnetic Resonance Laboratory.** Pelegrini, F. (Goias Univ., Goiania, GO (Brazil). Dept. de Fisica). Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

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1212 (INIS-BR–2942, pp. 97) **Verification of maximum stresses in the CTS-1 sodium loop heat exchangers during the solidified sodium removal operation.** Correia Filho, A. (Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores); Brito Aghina, L.O. de. Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1989. 147p. (In Portuguese). In *Triennial technical report - 1986, 1987, 1988 - Instituto de Engenharia Nuclear (IEN) -Dept. of Reactors (DERE).* Order Number DE93605069. Source: OSTI; NTIS (US Sales Only); INIS.

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Published in summary form only. COOLANT LOOPS/heat exchangers; HEAT EXCHANGERS/sodium; FINITE ELEMENT METHOD; SODIUM; P CODES; PIPELINES; SOLIDIFICATION; STRESSES

1213 (INIS-mf–13349, pp. 12) **Modification of neutron radiography system, in remote control of film, cassette and sample handling.** Maher, R. (Atomic Energy Organization of Iran, Teheran (Iran, Islamic Republic of). Nuclear Research Centre); Kamali Mogaddam, K. Iranian Physics Society, Teheran (Iran, Islamic Republic of). 1991. 53p. (In Persian). (CONF-9109417–: Iran's physics conference, Isfahan (Iran, Islamic Republic of), 10 Sep 1991). In *Abstract of articles from Iran's physics conference.* Order Number DE93000811. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. MATERIALS HANDLING EQUIPMENT/neutron radiography; AUTOMATION; REMOTE CONTROL; SHIELDS; SPECIFICATIONS

1214 (LA-UR–92-1981) **Impact modeling with Smooth Particle Hydrodynamics.** Stellingwerf, R.F.; Wingate, C.A. Los Alamos National Lab., NM (United States). [1992]. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-921221–2: High velocity impact symposium, Austin, TX (United States), Dec 1992). Order Number DE92017506. Source: OSTI; NTIS; GPO Dep.

Smooth Particle Hydrodynamics (SPH) is a new computational technique uniquely suited to computation of hypervelocity impact phenomena. This paper reviews the characteristics, philosophy, and a bit of the derivation of the method. As illustrations of the technique, several test case computations and several application computations are shown.

1215 (LA-UR–92-2961) **Development of methodology for certification of Type B shipping containers using analytical and testing techniques.** Sharp, R.R.; Varley, D.T. Los Alamos National Lab., NM (United States). [1992]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-920905–27: 10. international symposium on the packaging and transportation of radioactive materials: PATRAM '92, Yokohama (Japan), 13-18 Sep 1992). Order Number DE93000689. Source: OSTI; NTIS; INIS; GPO Dep.

The Analysis and Testing Group (WX-11) of the Design Engineering Division at Los Alamos National Laboratory (LANL) is developing methodology for designing and providing a basis for certification of Type B shipping containers. This methodology will include design, analysis, testing, fabrication, procurement, and obtaining certification of the Type B containers, allowing usage in support of the United States Department of Energy programs. While all aspects of the packaging development are included in this methodology, this paper focuses on the use of analysis and testing techniques for enhancing the design and providing a basis for certification. This methodology is based on concurrent engineering principles. Multidisciplinary teams within LANL are responsible for the design and certification of specific Type B Radioactive Material Shipping Containers. These teams include personnel with the various backgrounds and areas of expertise required to support the design, testing, analysis and certification tasks. To demonstrate that a package can pass all the performance requirements, the design needs to be characterized as completely as possible. Understanding package responses to the various environments and how these responses influence the effectiveness of the packaging requires expertise in several disciplines. In addition to characterizing the shipping container designs, these multidisciplinary teams should be able to provide insight into improving new package designs.

1216 (LA-UR–92-3074) **Modification of earth-satellite orbits using medium-energy pulsed lasers.** Phipps, C.R. Los Alamos National Lab., NM (United States). [1992]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-920959–2: 9. international symposium on gas flow and chemical lasers, Heraklion (Greece), 21-25 Sep 1992) Order Number DE93000858. Source: OSTI; NTIS; GPO Dep.

Laser Impulse Space Propulsion (LISP) has become an attractive concept, due to recent advances in gas laser technology, high-speed segmented mirrors and improved coeffici-ents for momentum coupling to targets in pulsed laser ablation. There are numerous specialized applications of the basic concept to space science-ranging from far-future and high capital cost to the immediate and inexpensive, such as: LEO-LISP (launch of massive objects into low-Earth-Orbit at dramatically improved cost-per-kg relative to present practice); LEGO-LISP (LEO to geosynchronous transfers); LO-LISP) (periodic re-boost of decaying LEO orbits) and LISK (geosynchronous satellite station-keeping). It is unlikely that one type of laser will be best for all scenarios. In this paper, we will focus on the last two applications.

1217 (LA-UR–92-3182) **Part mounting revisited.** Hannah, P.R.; Garcia, F.P.; Stewart, D.D. Los Alamos National Lab., NM (United States). [1992]. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-9210104–4: 7. annual conference of the American Society for Precision Engineering (ASPE), Orlando, FL (United States), 18-23 Oct 1992). Order Number DE93000871. Source: OSTI; NTIS; GPO Dep.

Having been involved with single point diamond turning since the 1960's; I share with others of my age, a unique perspective of the craft. I am amazed at how the fundamentals seem to be forgotten or misplaced, and need to be re emphasized and re learned. Each new precision machine operator not only needs to re learn (many

times the hard way), these fundamentals, but seems to inherit all the folklore; good and bad, from his predecessor. Let me explain. I spend some of my time as a consultant to the shops' division at the Los Alamos National Laboratory, at which there are five precision turning machines divided between two buildings. The main shop area houses an old friction way (hydrodynamic) turning Machine. The base of this turning machine is made from the base of an old Moore measuring machine. The air bearing spindle, a "Red Head" was made by the Heald Machine Tool Co. With the addition of an Allen-Bradley Numerical control system, this machine has become a work horse, used primarily to make smooth flat surfaces in the fly-cutting mode. Recently, I became involved in the evaluation and repair of the machine as it no longer produced smooth surfaces. Smooth surfaces are not the point of this narrative, accurate geometry however is.

1218 (ORNL/TM–12163) **Preparing EBS messages.** Vogt, B.M., Sorensen, J.H. Oak Ridge National Lab., TN (United States). Sep 1992. 34p. Sponsored by Federal Emergency Management Agency, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93000835. Source: OSTI; NTIS; GPO Dep.

Warning messages transmitted to populations at risk from an accidental release of chemical agent must be carefully designed to maximize appropriate responses from affected publics. This guide develops an approach for preparing Emergency Broadcast System (EBS) messages for the Chemical Stockpile Emergency Preparedness Program (CSEPP). Sample messages illustrate the application of this approach. While the sample messages do not cover every emergency situation, the texts are generic in that accident and location specific factors can be incorporated into the final message developed by local emergency planners. Thus they provide a starting point, not an end product, for emergency planners.

1219 (ORNL/TM–12165) **Input relegation control for gross motion of a kinematically redundant manipulator.** Unseren, M.A. Oak Ridge National Lab., TN (United States). Oct 1992. 40p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93002735. Source: OSTI; NTIS; GPO Dep.

This report proposes a method for resolving the kinematic redundancy of a serial link manipulator moving in a three-dimensional workspace. The underspecified problem of solving for the joint velocities based on the classical kinematic velocity model is transformed into a well-specified problem. This is accomplished by augmenting the original model with additional equations which relate a new vector variable quantifying the redundant degrees of freedom (DOF) to the joint velocities. The resulting augmented system yields a well specified solution for the joint velocities. Methods for selecting the redundant DOF quantifying variable and the transformation matrix relating it to the joint velocities are presented so as to obtain a minimum Euclidean norm solution for the joint velocities. The approach is also applied to the problem of resolving the kinematic redundancy at the acceleration level. Upon resolving the kinematic redundancy, a rigid body dynamical model governing the gross motion of the manipulator is derived. A control architecture is suggested which according to the model, decouples the Cartesian space DOF and the redundant DOF.

1220 (PNL–8330) **Pacific Northwest Laboratory FY 1993 Site Maintenance Plan for maintenance of DOE nonnuclear facilities.** Bright, J.D. Pacific Northwest Lab., Richland, WA (United States). 28 Sep 1992. 101p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93000841. Source: OSTI; NTIS; GPO Dep.

This Site Maintenance Plan has been developed for Pacific Northwest Laboratory's (PNL) Nonnuclear Facilities. It is based on requirements specified by US Department of Energy (DOE) Order 4330.4A, Chapter I, Change No. 4. The objective of this maintenance plan is to provide baseline information for compliance to the DOE Order 4330.4A, to identify needed improvements, and to document the planned maintenance budget for Fiscal Year (FY) 1993 and to estimate maintenance budgets for FY 1994 and FY 1995 for all PNL facilities. Using the results of the self-assessment, PNL has selected 12 of the 36 elements of the Maintenance Program defined by DOE Order 4330.4A, Chapter I, for improvement. The elements selected for improvement are: Facility Condition Inspections; Work Request (Order) System; Formal Job Planning and Estimating; Work Performance (Time) Standards; Priority System; Maintenance Procedures and Other Work-Related Documents; Scheduling System; Post Maintenance Testing; Backlog Work Control; Equipment Repair History and Vendor Information; Work Sampling; and Identification and Control. Based upon a graded approach and current funding, those elements considered most important have been selected as goals for earliest compliance. Commitment dates for these elements have been established for compliance. The remaining elements of noncompliance will be targeted for implementation during later budget periods.

1221 (PNL-SA–20751) **Power beaming providing a space power infrastructure.** Bamberger, J.A.; Coomes, E.P. Pacific Northwest Lab., Richland, WA (United States). Aug 1992. 7p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-920801–26: 27. intersociety energy conversion engineering conference, San Diego, CA (United States), 3-7 Aug 1992). Order Number DE93000850. Source: OSTI; NTIS; GPO Dep.

This study, based on two levels of technology, applies the power beaming concept to four planned satellite constellations. The analysis shows that with currently available technology, power beaming can provide mass savings to constellations in orbits ranging from low earth orbit to geosynchronous orbit. Two constellations, space surveillance and tracking system and space based radar, can be supported with current technology. The other two constellations, space-based laser array and boost surveillance and tracking system, will require power and transmission system improvements before their breakeven specific mass is achieved. A doubling of SP-100 conversion efficiency from 10 to 20/% would meet or exceed breakeven for these constellations.

1222 (SAND–91-2255C) **Comparison of 10 CFR 71 normal conditions with bounding US "hot day" extremes.** Brown, N.N. (Sandia National Labs., Albuquerque, NM (United States)); Gianoulakis, S.E.; Lake, W.H. Sandia National Labs., Albuquerque, NM (United States). [1991]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-920631–47: American Society of Mechanical Engineers pressure vessel and piping conference, New Orleans, LA (United States), 21-25 Jun 1992). Order Number DE92040976. Source: OSTI; NTIS; INIS; GPO Dep.

Simple thermal models representing surface and near-surface conditions of spent fuel casks are developed to assess the behavior of such cask regions to normal hot day conditions of 10 CFR 71 and bounding hot day extreme environments within the continental US. In general, it is found that the relatively simple regulatory conditions for hot day environments are reasonable predictors of bounding cask responses to actual hot day extremes. For cask configurations whose outer regions can be described as thin plates with adiabatic backfaces, designers need to assure adequate thermal design margins for temperature-sensitive surface components.

1223 (SAND–91-2602C) **Intermodal transfer of spent fuel.** Neuhauser, K.S. (Sandia National Labs., Albuquerque, NM (United States)); Weiner, R.F. Sandia National Labs., Albuquerque, NM (United States). [1991]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (TTC–1120;CONF-920905–29: 10. international symposium on the packaging and transportation of radioactive materials: PATRAM '92, Yokohama (Japan), 13-18 Sep 1992). Order Number DE93000720. Source: OSTI; NTIS; INIS; GPO Dep.

As a result of the international standardization of containerized cargo handling in ports around the world, maritime shipment handling is particularly uniform. Thus, handier exposure parameters will be relatively constant for ship-truck and ship-rail transfers at ports throughout the world. Inspectors' doses are expected to vary because of jurisdictional considerations. The results of this study should be applicable to truck-to-rail transfers. A study of the movement of spent fuel casks through ports, including the loading and unloading of containers from cargo vessels, afforded an opportunity to estimate the radiation doses to those individuals handling the spent fuels with doses to the public along subsequent transportation routes of the fuel. A number of states require redundant

inspections and for escorts over long distances on highways; thus handlers, inspectors, escort personnel, and others who are not normally classified as radiation workers may sustain doses high enough to warrant concern about occupational safety. This paper addresses the question of radiation safety for these workers. Data were obtained during, observation of the offloading of reactor spent fuel (research reactor spent fuel, in this instance) which included estimates of exposure times and distances for handlers, inspectors and other workers during offloading and overnight storage. Exposure times and distance were also for other workers, including crane operators, scale operators, security personnel and truck drivers. RADTRAN calculational models and parameter values then facilitated estimation of the dose to workers during incident-free ship-to-truck transfer of spent fuel.

1224 (SAND–91-2666C) **Results of the Sandia National Laboratories MOSAIK cask drop test program.** Sorenson, K.; Salzbrenner, R.; Wellman, G.; Bobbe, J. Sandia National Labs., Albuquerque, NM (United States). [1991]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-920905–25: 10. international symposium on the packaging and transportation of radioactive materials: PATRAM '92, Yokohama (Japan), 13-18 Sep 1992). Order Number DE92041161. Source: OSTI; NTIS; GPO Dep.

There has been a significant international effort over the past ten years to qualify structural materials for construction of radioactive material (RAM) transportation casks. As total life cycle cost analyses argue the necessity for more efficient casks, new candidate structural materials are evaluated relative to the historically accepted austenitic stainless steels. New candidate cask containment materials include ferritic steels, ductile iron, depleted uranium, and titanium. Another material, borated stainless steel is being considered for structural cask internals because of its neutron absorption properties. The mechanical performance of the borated stainless steels is a function of the boron content and metallurgical processing conditions. A separate paper in this symposium (Stephens et al. 1992) deals with the properties of a range of borated stainless steels. A major technical issue involved with the qualification of afl these candidate materials is that they may, under certain combinations of mechanical and environmental loading, fail in a brittle fashion. Such a failure would of course not be acceptable for a RAM transport cask involved in an accident. The cask designer must assure cask owners, regulators as well as the general public that the cask will not undergo brittle fracture for all regulatory loading conditions. This paper summarizes the drop tests that were conducted using the MOSAIK casks to verify the fracture mechanics cask design approach and to demonstrate that ductile iron could be subjected to severe loading conditions without failing in a brittle manner.

1225 (SAND–91-2669C) **Burnup credit issues in transportation and storage.** Brady, M.C. (Sandia National Labs., Albuquerque, NM (United States)); Sanders, T.L.; Seager, K.D.; Lake, W.H. Sandia National Labs., Albuquerque, NM (United States). [1992]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-920905–35: 10. international symposium on the packaging and transportation of radioactive materials: PATRAM '92, Yokohama (Japan), 13-18 Sep 1992). Order Number DE93000744. Source: OSTI; NTIS; INIS; GPO Dep.

Reliance on the reduced reactivity of spent fuel for criticality control during transportation and storage is referred to as burnup credit. This concept has attracted international interest and is being actively pursued in the United States in the development of a new generation of transport casks. An overview of the US experience in developing a methodology to implement burnup credit in an integrated approach to transport cask design is presented in this paper. Specifically, technical issues related to the analysis, validation and implementation of burnup credit are identified and discussed.

1226 (SAND–91-2687C) **Transportation package design using numerical optimization.** Harding, D.C.; Witkowski, W.R. Sandia National Labs., Albuquerque, NM (United States). [1991]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-920905–11: 10. international symposium on the packaging and transportation of radioactive materials: PATRAM '92, Yokohama (Japan), 13-18 Sep 1992). Order Number DE92041147. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of this overview is twofold: first, to outline the theory and basic elements of numerical optimization; and second, to show how numerical optimization can be applied to the transportation packaging industry and used to increase efficiency and safety of radioactive and hazardous material transportation packages. A more extensive review of numerical optimization and its applications to radioactive material transportation package design was performed previously by the authors (Witkowski and Harding 1992). A proof-of-concept Type B package design is also presented as a simplified example of potential improvements achievable using numerical optimization in the design process.

1227 (SAND–92-1288C) **Diagnostic behavior of the Wire Arc Plasma spray process.** Kowalsky, K.A. (Flame-Spray Industries, Inc., Stony Brook, NY (United States)); Marantz, D.R.; Neiser, R.A.; Smith, M.F. Sandia National Labs., Albuquerque, NM (United States). [1992]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-9206135–7: 1992 international thermal spray conference, Orlando, FL (United States), 1-5 Jun 1992). Order Number DE93000717. Source: OSTI; NTIS; GPO Dep.

Laser two-focus (L2F) velocimetry has been used to measure particle velocities in the Wire Arc Plasma spray process. Particle velocities were measured for aluminum, stainless steel, and copper feedstock with wire diameters of 1.6 mm and 0.9 mm. The Wire Arc Plasma gun was operated in both a single-gas mode, using air, and in a two-gas mode, using a mixture of argon/35% hydrogen as the primary plasma gas with pure argon as the secondary gas. The results indicate that maximum particle velocities are as high as 180 m/s for aluminum sprayed using air and 130 m/s using the argon/hydrogen mixture. The results also show that arc current and wire feed rate have little effect on particle velocity; however, particle velocities increase significantly with decreasing wire diameter and with decreasing density of the feedstock material.

1228 (SAND–92-1471C) **STACE: Source Term Analyses for Containment Evaluations of transport casks.** Seager, K.D. (Sandia National Labs., Albuquerque, NM (United States)); Gianoulakis, S.E.; Barrett, P.R.; Rashid, Y.R.; Reardon, P.C. Sandia National Labs., Albuquerque, NM (United States). [1992]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-920905–18: 10. international symposium on the packaging and transportation of radioactive materials: PATRAM '92, Yokohama (Japan), 13-18 Sep 1992). Order Number DE92041150. Source: OSTI; NTIS; INIS; GPO Dep.

Following the guidance of ANSI N14.5, the STACE methodology provides a technically defensible means for estimating maximum permissible leakage rates. These containment criteria attempt to reflect the true radiological hazard by performing a detailed examination of the spent fuel, CRUD, and residual contamination contributions to the releasable source term. The evaluation of the spent fuel contribution to the source term has been modeled fairly accurately using the STACE methodology. The structural model predicts the cask drop load history, the mechanical response of the fuel assembly, and the probability of cladding breach. These data are then used to predict the amount of fission gas, volatile species, and fuel fines that are releasable from the cask. There are some areas where data are sparse or lacking (e.g., the quantity and size distribution of fuel rod breaches) in which experimental validation is planned. The CRUD spallation fraction is the major area where no quantitative data has been found; therefore, this also requires experimental validation. In the interim, STACE conservatively assumes a 100% spallation fraction for computing the releasable activity. The source term methodology also conservatively assumes that there is 1 Ci of residual contamination available for release in the transport cask. However, residual contamination is still by far the smallest contributor to the source term activity.

1229 (UCRL-JC–109423) **Two-dimensional computer calculation of high-power microwave bandwidth broadening by air breakdown in a rectangular waveguide.** Mayhall, D.J.; Yee, J.H. Lawrence Livermore National Lab., CA (United States). Jun 1992. 3p. Sponsored by USDOE, Washington, DC (United States).

DOE Contract W-7405-ENG-48. (CONF-920638–1: 19. Institute of Electrical and Electronic Engineers (IEEE) international conference on plasma science, Tampa, FL (United States), 1-3 Jun 1992). Order Number DE92041083. Source: OSTI; NTIS; GPO Dep.

Extended abstract.

Short communication. BREAKDOWN/computer calculations; AIR/breakdown; RADAR; BREAKDOWN; AIR; TWO-DIMENSIONAL CALCULATIONS; WAVEGUIDES; ELECTROMAGNETIC PULSES; MICROWAVE RADIATION; LINE BROADENING

1230 (Y/EN–4593) **Test procedure for removal and handling of test specimens: Hollow clay tile wall test program: Revision 1.** Jones, W.D.; Hornyak, G.J. Oak Ridge Y-12 Plant, TN (United States). Jan 1992. 84p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OS21400. (HCTP–3-R1). Order Number DE92041222. Source: OSTI; NTIS; GPO Dep.

This document describes the techniques for removal and handling of five types of Hollow Clay Tile Wall (HCTW) specimens. The handling fixture required for removal of each wall specimen as shown on the procedure for that specimen is supplied by energy systems. Fixture drawing numbers are listed.

1231 (Y/EN–4729) **Inter-story drift effects on the in-plane capacity of infilled frames.** Flanagan, R.D. (Martin Marietta Energy Systems, Inc., Oak Ridge, TN (United States)); Bennett, R.M. Oak Ridge Y-12 Plant, TN (United States). 4 Aug 1992. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OS21400. (CONF-9210169–1: 3. international masonry conference, London (United Kingdom), 24-31 Oct 1992). Order Number DE92041273. Source: OSTI; NTIS; GPO Dep.

The effect of out-of-plane inter-story drift on the in-plane capacity of unreinforced hollow clay tile infilled frames was evaluated by testing three large-scale specimens. Two of the specimens were first subjected to cyclic out-of-plane displacements imposed either at the top or at midheight of the infill. Little relative movement was observed between the tile infill and the bounding frame. Both specimens were then loaded in-plane to failure. The results were compared to a third identical specimen that was only loaded in-plane to failure. In-plane strength and stiffness degradation resulting from the out-of-plane drift loading was minimal. The testing is part of a comprehensive research program unreinforced masonry infill behavior that is currently investigating underway at the US Department of Energy's oak Ridge Y-12 Plant.

4204 Heat Transfer and Fluid Flow

Refer also to citation(s) 243, 533, 567, 574, 690

1232 (ANL–92/12) **Boiling heat transfer of refrigerant R-113 in a small-diameter, horizontal tube.** Wambsganss, M.W. (Argonne National Lab., IL (United States)); Jendrzejczyk, J.A.; Tran, T.N.; France, D.M. Argonne National Lab., IL (United States). Jan 1992. 39p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE93002351. Source: OSTI; NTIS; GPO Dep.

Results of a study of boiling heat transfer from refrigerant R-113 in a small-diameter (2.92-mm) tube are reported. Local heat transfer coefficients over a range of heat fluxes, mass fluxes, and equilibrium mass qualities were measured. The measured coefficients were used to evaluate eight different heat transfer correlations, some of which have been developed specifically for refrigerants. High heat fluxes and low flow rates are inherent in small channels, and this combination results in high boiling numbers. The high boiling number of the collected data shows that the nucleation mechanism was dominant. As a result, the two-phase correlations that predicted this dominance also predicted the data best if they also properly modeled the physical parameters. The correlations of Lazarek and Black and of Shah, as modified in this study, predicted the data very well. It is also shown that a simple form, suggested by Stephan and Abdelsalam for nucleate boiling, correlates the data equally well. This study is part of a research program in multiphase flow and heat transfer, with the overall objective of developing validated design correlations and predictive methods that will facilitate the design and optimization of compact heat exchangers for use with environmentally acceptable alternatives for chlorofluorocarbon (CFC) refrigerants and refrigerant mixtures.

1233 (DOE/ER/12820–2) **Siphon breaker design requirements: Progress report.** Neill, D.T.; Stephens, A.G. Idaho State Univ., Pocatello, ID (United States). Coll. of Engineering. [1990]. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG07-88ER12820. Order Number DE93000675. Source: OSTI; NTIS; GPO Dep.

This project was intended to provide experimental data on siphon flow effects. The system was to be modeled with the RELAP code and the predicted and measured performances compared. The experimental system consists of a 500-gallon upper tank, a 4-inch downcomer pipe, a lower catch tank, a return pump and associated piping. The downcomer pipe is made of 4-inch clear acrylic pipe so the flow patterns could be observed and video taped during the test runs.

1234 (DOE/ER/12933–3) **Film boiling from spheres in single- and two-phase flow.** Liu, C.; Theofanous, T.G.; Yuen, W.W. California Univ., Santa Barbara, CA (United States). Dept. of Chemical and Nuclear Engineering. [1992]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-90ER12933. (CONF-920804–24: American Society of Mechanical Engineers national heat transfer conference and exposition, San Diego, CA (United States), 9-12 Aug 1992). Order Number DE93000887. Source: OSTI; NTIS; INIS; GPO Dep.

Experimental data on film boiling heat transfer from single, inductively heated, spheres in single- and two-phase flow (saturated water and steam, respectively) are presented. In the single-phase-flow experiments water velocities ranged from 0.1 to 2.0 m/s; in the two-phase-flow experiments superficial water and steam velocities covered 0.1 to 0.6 m/s and 4 to 10 m/s, respectively. All experiments were run at atmospheric pressure and with sphere temperatures from 900C down to quenching. Limited interpretations of the single-phase- flow data are possible, but the two-phase-flow data are new and unique.

1235 (DOE/ER/13032–T2) **Development of an electrical impedance computed tomographic two-phase flows analyzer: Progress report for the period 1 October 1990–31 May 1992.** Jones, O.C. Rensselaer Polytechnic Inst., Troy, NY (United States). Dept. of Nuclear Engineering and Engineering Physics. 31 Mar 1992. 85p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AT06-82ER13032. Order Number DE92040527. Source: OSTI; NTIS; GPO Dep.

Description of interfacial structure and evolution, as well as the gradients which control transfer of mass, momentum, and energy at these phase boundaries is a critical challenge for the future of two-phase flow analysis. Indeed, measurement and prediction of phase boundary structure and gradients is the key element impeding development of true predictive capability for systems involving flows of liquid and vapor or gas mixtures. This report summarizes the current status of research being undertaken for the development of an electrical impedance method which can then be used for computed tomographic reconstruction of the flow field. The concept is relatively straight forward. A volume of a liquid-vapor flow is excited electrically through means of boundary electrodes. the response is measured and the internal distribution of electrical properties is determined which best matches the measured response. This is termed an "inverse problem" since it is directly inverse to the "forward problem" where the field properties and boundary conditions are known and the electrical field is computed. Since both electrical resistivity and permittivity of water and vapor are significantly different in each fluid, development of this method having sufficient rapidity will allow interfacial structure and evolution to be determined for two-phase flows. Methods for solution to this nonlinear problem are iterative in nature. A property distribution is assumed, response to the applied excitation is calculated and compared with the measured response, and calculations in the original distribution are undertaken which push the calculations in the direction of the measurements. We attempt to minimize the mean-square error between the computations and the measurements on the boundary by suitable adjustment of the internal distribution of resistivity and permittivity.

1236 (DOE/ER/13764–T3) **Interfacial area and interfacial transfer in two-phase flow systems: Annual technical progress report, 1991–1992.** Kojasoy, G. Wisconsin Univ., Milwaukee, WI (United States). Dept. of Mechanical Engineering. Aug 1992. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-87ER13764. Order Number DE93000647. Source: OSTI; NTIS; GPO Dep.

Experiments were performed on horizontal air-water bubbly two-phase flow, axial flow, stratified wavy flow, and annular flow. Theoretical studies were also undertaken on interfacial parameters for a horizontal two-phase flow. (DLC)

1237 (DOE/OR/00033–T485) **Identification of significant process variables for a flow-through supercritical water oxidation reactor.** Rossi, R.E. (Cornell Univ., Ithaca, NY (United States)). Oak Ridge Inst. for Science and Education, TN (United States); Cornell Univ., Ithaca, NY (United States). May 1992. 138p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-76OR00033. Order Number DE92041033. Source: OSTI; NTIS; INIS; GPO Dep.

The effects of four process variables on the destruction efficiency of a flow-through supercritical water oxidation reactor were investigated. These process variables included: (1) reactor throughput (GPH), (2) concentration of the surrogate waste (% acetone), (3) maximum reactor tube-wall temperature (OC), and (4) applied stoichiometric oxygen. The analysis was conducted utilizing two-level factorial experiments, steepest ascent methods, and central composite designs. This experimental protocol assures efficient experimentation and allows for an empirical response surface model of the system to be developed. This experimentation identified a significant positive effect for stoichiometric oxygen applied and temperature variations between 400 to 500°C. The increase in destruction efficiency due to stoichiometric 0_2 provides strong evidence that supercritical water oxidations are catalyzed by excess oxygen, and the strong temperature effect is a result of large increases in the kinetic rates for this temperature range. However, increasing temperature between 550 to 650°C does not provide substantial increases in destruction efficiency. In addition, destruction efficiency is significantly unproved by increasing the Reynolds number and residence time. The destruction efficiency of the reactor is also dependent upon the initial concentration of surrogate waste. This concentration dependence may indicate first-order supercritical CO kinetics is inadequate for describing all waste types and reactor configurations. Alternatively, it may indicate reactant mixing, caused by local turbulence at the oxidation fronts of these higher concentration waste streams, results in higher destruction efficiencies.

1238 (DOE/PC/79903–T18) **Optical properties of fly ash: Quarterly report, 1 Apr 1988–30 June 1988.** Self, S.A. Stanford Univ., CA (United States). High Temperature Gasdynamics Lab. Jul 1988. 30p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-87PC79903. Order Number DE93001871. Source: OSTI; NTIS; GPO Dep.

This task is planned to provide the basic optical properties data in a comprehensive and conveniently usable form. The optical constants (i.e., the components of the complex refractive index m = n - ik) of samples of synthetic slags of controlled compositions will be measured using established techniques involving transmission and surface reflectance methods. The wavelength range will extend from the visible to 12 μm and the temperature range will extend to 2000K. Initially, the optical constants of the basic calcium-aluminosilicate host glass will be determined for the composition range defined by Task 1. Subsequently, by adding infrared-active mineral oxide constituents in controlled amounts, one at a time, the modifications to m(Λ, T) produced by such constituents will be quantitatively determined. The particular constituents (and their range of mass fractions) to be examined will be determined by those disclosed by Task 1, taking account of knowledge of the optical activity at relevant wavelengths of such additions from the literature of glass technology. Specific constituents to be examined will include Fe_2O_3, taking especial account of its valence state (Fe^{2+}/Fe^{3+} ratio), and of TiO_2. The contribution of the OH radical to the optical properties will be evaluated and quantified if significant. The experimental data on m(Λ,T) as a function of composition, over the range relevant to coal ashes, will be reduced to generate simple correlation formulae. The latter will constitute the data base necessary to calculate the radiative properties of bulk slags and ash dispersions required for understanding and computing radiative transfer in coal combustion systems.

1239 (DOE/PC/91297–4) **A computational model for coal transport and combustion: Quarterly technical progress report, June 1, 1992–August 31, 1992.** Ahmadi, G. Clarkson Univ., Potsdam, NY (United States). Dept. of Mechanical and Aeronautical Engineering. [1992]. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-91PC91297. Order Number DE93000722. Source: OSTI; NTIS; GPO Dep.

Further progress has been made in formulation of the thermodynamically consistent, rate dependent model for turbulent two-phase flows. The thermodynamically admissible constitutive equations were derived, and the case of a simple shear flow was studied. The kinetic model for rapid flows of granular materials, which includes frictional losses, was used for studying gravity flow down an inclined chute. Some typical velocity profiles were obtained and the results were compared with the data of Savage. The effect of interparticle friction was also studied. Progress has been made in developing a computational model for rapid granular and two-phase flows in complex geometries. A discrete element numerical scheme was used for granular flow analysis. A predictor-corrector numerical procedure was developed for analyzing two-phase flows. Progress has been made in the construction of the experimental simple shear flow device. The design of the device was improved and its main body was assembled.

1240 (DTH-AFM–91-04) **Heat transfer research in Denmark.** Scheel Larsen, P. Danmarks Tekniske Hoejskole, Lyngby (Denmark). Afd. for Fluid Mekanik. Aug 1991. 21p. (CONF-9108222–1: 1. Baltic heat transfer conference, Goeteborg (Sweden), 26-28 Aug 1991). Order Number DE93721475. Source: OSTI; NTIS.

An overview is given of research activities in the field of heat transfer in Denmark, occasionally including mass transfer. The summary does not claim to be complete, most entries being from the university community. The survey is organized by institution, giving a statement of general activities followed by specific samples. (au) (31 refs.).

1241 (FEI–2037) **Technique for calculation of heat transfer crisis in tube-type steam generating channels under uniform heating along the length.** Boltenko, Eh.A.; Katan, I.B.; Zyatnina, O.A. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk (Russian Federation). Fiziko-Ehnergeticheskij Inst. 1989. 26p. (In Russian). Order Number DE93605662. Source: OSTI; NTIS (US Sales Only); INIS.

Dependences for the calculation of critical heat fluxes over the whole two-phase flow existence range in case of water supply to the tube inlet, the water being underheated to saturation temperature, are presented. The choice of the dependences, boundaries of their application is made on the basis of modern concepts of heat transfer crisis mechanism and flow conditions of the two-phase mixture. The choice of the coefficients was made with regard to processing a large amount of experimental information, accumulated in the centre of thermal physics data. 13 refs.; 7 figs.; 1 tab.

1242 (INIS-BR–2942, pp. 67-68) **Flow rate calculation during the line drainage of the SS-50 sodium circuit confluent to the 05-M mixer.** Walsh, L.M. (Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores). Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1989. 147p. (In Portuguese). In *Triennial technical report - 1986, 1987, 1988 - Instituto de Engenharia Nuclear (IEN) -Dept. of Reactors (DERE).* Order Number DE93605069. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. COOLANT LOOPS/flow rate; COOLANT LOOPS/sodium; COMPUTER CALCULATIONS; SODIUM; MIXER-SETTLERS; TANKS; THERMAL STRESSES; TIME DEPENDENCE

1243 (INIS-BR–2942, pp. 70) **Operation of thermohydraulic measures laboratory.** Pereira, W.Q. (Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores); Santos, L.C.A. dos. Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1989. 147p. (In Portuguese). In *Triennial technical report - 1986, 1987, 1988 - Instituto de Engenharia Nuclear (IEN) -Dept. of Reactors (DERE).* Order Number DE93605069. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. LABORATORIES/temperature control; LABORATORIES/temperature measurement; EDUCATION; LABORATORIES; THERMOCOUPLES; THERMODYNAMICS

1244 (INIS-BR–2942, pp. 70-71) **Operation and maintenance of the CTS-1 sodium thermal loop.** Barbosa, A.L.N. (Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores); Pinto, A.J.R.; Bispo, D.A. Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1989. 147p. (In Portuguese). In *Triennial technical report - 1986, 1987, 1988 - Instituto de Engenharia Nuclear (IEN) -Dept. of Reactors (DERE).* Order Number DE93605069. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. COOLANT LOOPS/pipes; COOLANT LOOPS/restraints; CALIBRATION; COLD TRAPS; PIPES; RESTRAINTS; FLUID FLOW; MAINTENANCE; OPERATION; SODIUM

1245 (INIS-BR–2942, pp. 75-76) **Development of computer program for solution of a mathematical model to thermohydraulics calculation in sodium loops.** Walsh, L.M. (Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores). Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1989. 147p. (In Portuguese). In *Triennial technical report - 1986, 1987, 1988 - Instituto de Engenharia Nuclear (IEN) -Dept. of Reactors (DERE).* Order Number DE93605069. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. COOLANT LOOPS/fluid flow; COOLANT LOOPS/natural convection; BOUNDARY CONDITIONS; COMPUTER CALCULATIONS; FORCED CONVECTION; LOSS OF FLOW; MATHEMATICAL MODELS; SODIUM; TEMPERATURE DEPENDENCE; THERMODYNAMICS

1246 (INIS-BR–2942, pp. 76-77) **Experimental evaluation of the TV-CTS-1 code.** Cesar, S.B.G. (Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores). Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1989. 147p. (In Portuguese). In *Triennial technical report - 1986, 1987, 1988 - Instituto de Engenharia Nuclear (IEN) -Dept. of Reactors (DERE).* Order Number DE93605069. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. NATURAL CONVECTION/fluid flow; NATURAL CONVECTION/sodium; COMPUTER CALCULATIONS; COOLANT LOOPS; FORCED CONVECTION; SODIUM; T CODES

1247 (INIS-BR–2942, pp. 82) **Operation of the thermohydraulics measures laboratory.** Pereira, V.Q. (Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores); Cesar, S.B.G.; Santos, L.C.A. dos. Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1989. 147p. (In Portuguese). In *Triennial technical report - 1986, 1987, 1988 - Instituto de Engenharia Nuclear (IEN) -Dept. of Reactors (DERE).* Order Number DE93605069. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. HYDRAULIC EQUIPMENT/pressure gages; HYDRAULIC EQUIPMENT/temperature measurement; CALIBRATION; LABORATORIES; OPERATION; THERMOCOUPLES; THERMOMETERS

1248 (INIS-BR–2942, pp. 92) **Sodium temperature evaluation during a cold thermal shock.** Jesus Miranda, C.A. de (Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores); Gebrim, A.N. Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1989. 147p. (In Portuguese). In *Triennial technical report - 1986, 1987, 1988 - Instituto de Engenharia Nuclear (IEN) -Dept. of Reactors (DERE).* Order Number DE93605069. Source: OSTI; NTIS (US Sales Only); INIS.

Published in full form as CT-DIMEC 01/87.

Published in summary form only. COOLANT LOOPS/thermal shock; COOLANT LOOPS/thermal testing; SODIUM/temperature dependence; SODIUM/thermal shock; B CODES; COMPUTER CALCULATIONS; EVALUATION; SODIUM

1249 (INIS-BR–2942, pp. 126) **Modified operator analysis on convection-diffusion problems.** Sampaio, P.A.B. de (Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Div. de Termohidraulica de Reatores). Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1989. 147p. (CONF-8812106–: 2. national meeting of thermal science, Aguas de Lindoia (Brazil), 6-8 Dec 1988). In *Triennial technical report - 1986, 1987, 1988 - Instituto de Engenharia Nuclear (IEN) -Dept. of Reactors (DERE).* Order Number DE93605069. Source: OSTI; NTIS (US Sales Only); INIS.

Published in full form as CT-IEN-DERE-DITRE 04/88.

Published in summary form only. CONVECTION/mathematical operators; CONVECTION; FINITE ELEMENT METHOD; GALERKIN-PETROV METHOD; ONE-DIMENSIONAL CALCULATIONS; TWO-DIMENSIONAL CALCULATIONS

1250 (INIS-BR–2942, pp. 119-120) **Incompressible viscous flows: a two-dimensional analysis.** Sampaio, P.A.B. de (Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Div. de Termohidraulica de Reatores). Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1989. 147p. (In Portuguese). In *Triennial technical report - 1986, 1987, 1988 - Instituto de Engenharia Nuclear (IEN) -Dept. of Reactors (DERE).* Order Number DE93605069. Source: OSTI; NTIS (US Sales Only); INIS.

Published in full form as CT-DITRE 02/87.

Published in summary form only. VISCOUS FLOW/two-dimensional calculations; CONVECTION; FINITE ELEMENT METHOD; FLOW RATE; LAMINAR FLOW; NUMERICAL SOLUTION; TEMPERATURE DEPENDENCE

1251 (INIS-BR–2942, pp. 120-121) **Modifications in TEACH-C computer code for convection-diffusion transients analysis in two dimensions.** Sampaio, P.A.B. de (Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Div. de Termohidraulica de Reatores). Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1989. 147p. (In Portuguese). In *Triennial technical report - 1986, 1987, 1988 - Instituto de Engenharia Nuclear (IEN) -Dept. of Reactors (DERE).* Order Number DE93605069. Source: OSTI; NTIS (US Sales Only); INIS.

Published in full form as CT-DITRE 06/87.

Published in summary form only. HEAT TRANSFER/computerized simulation; COMPARATIVE EVALUATIONS; FINITE ELEMENT METHOD; T CODES; TRANSIENTS; TWO-DIMENSIONAL CALCULATIONS

1252 (INIS-BR–2942, pp. 121-122) **Utilization manual of the computer program FLUIDO-2D.** Sampaio, P.A.B. de (Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Div. de Termohidraulica de Reatores). Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1989. 147p. (In Portuguese). In *Triennial technical report - 1986, 1987, 1988 - Instituto de Engenharia Nuclear (IEN) -Dept. of Reactors (DERE).* Order Number DE93605069. Source: OSTI; NTIS (US Sales Only); INIS.

Published in full form as CT-DITRE 07/87.

Published in summary form only. CONVECTION/laminar flow; COMPUTER CALCULATIONS; CONVECTION; F CODES; NAVIER-STOKES EQUATIONS

1253 (KAERI/RR–1046/91) **The thermal-hydraulic characteristics of the nuclear reactor core during accidents: Air-water flooding in multirod channels.** Cha, Jong Hee (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Jeong, Moon Ki; Won, Soon Yeon; Jeon, Hyung Kil. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Jan 1992. 168p. (In Korean). Order Number DE93605663. Source: OSTI; NTIS (US Sales Only); INIS.

The flooding phenomena in multirod channels were investigated experimentally. The effects of spacer grids on flooding were investigated. And the mixing vane effects on flooding were investigated also. Four types of spacer grids (SSG, WSVSG, IVSG, IWSG) and blockages were used in experiment. The spacer grid decreased the critical air flow rate for flooding in compared with the case of bare rods. But the mixing vane increased air flow rate compared with SSG, IVSG had the largest mixing effects. (Author).

1254 (KAERI/RR–1062/91) **Development of test technique for thermal properties of nuclear fuels.** Kang, Young Hwan (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Ryu, Woo Seog; Park, Jong Man; Choo, Kee Nam; Park, Sei Jin; Park, Jee Yoen. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Jan 1991. 133p. (In Korean). Order Number DE93605664. Source: OSTI; NTIS (US Sales Only); INIS.

A sound understanding of the thermal conductivity of nuclear materials is essential both successful prediction of fuel performance such as centerline temperature, temperature gradient of fuels and behaviors of fission gas release and to evaluation of heat transfer of fuel cladding and steam generator tube to heat exchanger media. Thus, in this study apparatuses and techniques for measuring thermal conductivity are surveved and set up, and thermal conductivity of nuclear materials is produced. The results will be applied to measuring thermal conductivity for developing nuclear materials of system components as well as fuels for advanced reactors. The data-base of thermal conductivity will be a basis for improving the domestic design code of fuels and for utilizing domestic nuclear materials. (Author).

1255 (KFK–5010) **FLUTAN input specifications.** Borgwaldt, H.; Baumann, W.; Willerding, G. Kernforschungszentrum Karlsruhe GmbH (Germany). Inst. fuer Neutronenphysik und Reaktortechnik; Kernforschungszentrum Karlsruhe GmbH (Germany). Projekt Nukleare Sicherheitsforschung. May 1991. 74p. Order Number DE93720172. Source: OSTI; NTIS (US Sales Only); INIS.

FLUTAN is a highly vectorized computer code for 3-D fluiddynamic and thermal-hydraulic analyses in cartesian and cylinder coordinates. It is related to the family of COMMIX codes originally developed at Argonne National Laboratory, USA. To a large extent, FLUTAN relies on basic concepts and structures imported from COMMIX-1B and COMMIX-2 which were made available to KfK in the frame of cooperation contracts in the fast reactor safety field. While on the one hand not all features of the original COMMIX versions have been implemented in FLUTAN, the code on the other hand includes some essential innovative options like CRESOR solution algorithm, general 3-dimensional rebalacing scheme for solving the pressure equation, and LECUSSO-QUICK-FRAM techniques suitable for reducing 'numerical diffusion' in both the enthalphy and momentum equations. This report provides users with detailed input instructions, presents formulations of the various model options, and explains by means of comprehensive sample input, how to use the code. (orig.).

1256 (NEI-NO–281) **Transient simulation of 2-3D stratified and intermittent two-phase flows.** Moe, R. Oslo Univ. (Norway). Matematisk Inst. 1992 65p. Order Number DE93721637. Source: OSTI; NTIS.

The thesis consists of two papers related to different aspects of two-and three-dimensional (2-3D) simulations of separated and intermittent flows. The first paper presents the physical basis, numerical method and solution algorithm of a proposed 2-3D transient two-fluid model. The general two-fluid equations have been applied, and closure laws for wall shear stress and interfacial momentum transfer with necessary assumptions and simplifications are discussed. A single pressure field, the local velocities and the specific masses including the volumetric fraction of the two phases are solved numerically by a semi-implicit finite difference scheme. The paper also includes detailed testing, and comparisons with other models. In the second paper the derived model has been applied to verification on two-phase flow problems. Different types of interfacial friction models for stratified and intermittent flows, including an interfacial tracking scheme, have also been investigated. The model has been applied to predict Taylor bubble propagation in horizontal and inclined channels. The results have been compared to experimental data and analytical solutions. Also phenomena like slug initiations and bubble turning in downward inclined channel flow have been simulated. 35 refs., 36 figs., 3 tabs.

1257 (NEI-NO–285) **Numerical simulation of stratified flows with different k-ϵ turbulence models.** Dagestad, S. Trondheim Univ. (Norway). Norges Tekniske Hoegskole. 1991 196p. Order Number DE93721665. Source: OSTI; NTIS; INIS.

The thesis comprises the numerical simulation of stratified flows with different k-ϵ models. When using the k-ϵ model, two equations are solved to describe the turbulence. The k-equation represents the turbulent kinetic energy of the turbulence and the ϵ-equation is the turbulent dissipation. Different k-ϵ models predict stratified flows differently. The standard k-ϵ model leads to higher turbulent mixing than the low-Reynolds model does. For lower Froude numbers, F_0, this effect becomes enhanced. Buoyancy extension of the k-ϵ model also leads to less vertical mixing in cases with strong stratification. When the stratification increases, buoyancy-extension becomes larger influence. The turbulent Prandtl number effects have large impact on the transport of heat and the development of the flow. Two different formulae which express the turbulent Prandtl effects have been tested. For unstably stratified flows, the rapid mixing and three-dimensionality of the flow can in fact be computed using a k-ϵ model when buoyancy-extended is employed. The turbulent heat transfer and thus turbulent production in unstable stratified flows depends strongly upon the turbulent Prandtl number effect. The main conclusions are: Stable stratified flows should be computed with a buoyancy-extended low-Reynolds k-ϵ model; Unstable stratified flows should be computed with a buoyancy-extended standard k-ϵ model; The turbulent Prandtl number effects should be included in the computations; Buoyancy-extension has lead to more correct description of the physics for all of the investigated flows. 78 refs., 128 figs., 17 tabs.

1258 (SAND–92-0694) **SAFSIM input manual: A computer program for the engineering simulation of flow systems.** Dobranich, D. Sandia National Labs., Albuquerque, NM (United States). Sep 1992. 129p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93002738. Source: OSTI; NTIS; GPO Dep.

SAFSIM (System Analysis Flow SIMulator) is a FORTRAN computer program to simulate the integrated performance of systems involving fluid mechanics, heat transfer, and reactor dynamics. SAFSIM provides sufficient versatility to allow the engineering simulation of almost any system, from a backyard sprinkler system to a clustered nuclear reactor propulsion system. In addition to versatility, speed and robustness are primary goals of SAFSIM. SAFSIM contains three basic physics modules: (1) a one-dimensional finite element fluid mechanics module with multiple flow network capability; (2) a one-dimensional finite element structure heat transfer module with multiple convection and radiation exchange surface capability; and (3) a point reactor dynamics module with reactivity feedback and decay heat capability. SAFSIM can be used for gas (compressible) or liquid (incompressible) single-phase flow systems with primary emphasis on gases (or supercritical fluids). This document contains a description of all the information required to create an input file for SAFSIM execution.

1259 (WSRC-MS–91-416) **Downward flow of water with entrained air in a nonuniformaly heated subdivided annulus.** Johnston, B.S.; May, C.P. Westinghouse Savannah River Co., Aiken, SC (United States). [1992]. 41p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. (CONF-920804–25: American Society of Mechanical Engineers national heat transfer conference and exposition, San Diego, CA (United States), 9-12 Aug 1992). Order Number DE93000593. Source: OSTI; NTIS; INIS; GPO Dep.

This paper describes an experimental study in which water was fed to a vertical annulus, entraining air in downward flow. The annulus was subdivided by longitudinal fins into four subchannels and was heated with an azimuthally varying heat flux. A bypass was provided to simulate flow in parallel channels. For steady liquid flow, inlet temperature, and pressure boundary conditions, the power was increased until critical heat flux was reached. Overheating characteristics were grouped according to the prevailing flow pattern. In annular flows ($j_L < 0.3$ m/s) overheating of the whole test section occurs when steam production causes countercurrent

flooding. In intermittent flows ($0.3 < j_L < 0.9$ m/s) the overheating is confined to a portion of the hot subchannel. The mechanism is postulated to be stagnation of a large bubble. In bubble flows ($0.9 \text{ m/s} < j_L$) overheating occurs by diverting inlet flow to the bypass and again involves the whole test section. Except at the very lowest flow rates, critical heat flux occurs when the effluent liquid temperature is below saturation.

4205 Materials Testing

Refer also to citation(s) 730, 1010, 1112, 1113, 1224, 1230, 1454, 1463, 2354, 2409

1260 (CEA-CONF–11029) **Simulations of ultrasonic examination using focused beams properties.** Calmon, P.; Gondard, C.; Lobjois, D. CEA Centre d'Etudes de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Technologie des Materiaux. 1992. 6p. (CONF-920463–: 11. international conference and exhibits on NDE in the nuclear and pressure vessel industries, Albuquerque, NM (United States), 29 Apr - 3 may 1992). Order Number DE93721149. Source: OSTI; NTIS (US Sales Only); INIS.

A simulation software based on a simplified model has been developed by the C.E.A. in order to predict the results of ultrasonic examinations. The algorithm account for the response of a crack close to the outer surface of a block examined with a focusing probe. It is based on a model described in this paper. This model allows to explain the main features observed on the echodynamic curves. Comparisons between experimental and simulated results show a quite good agreement.

1261 (CEA-CONF–11030) **Improvement of ultrasonic examination using the Spartacus system.** Benoist, P. (CEA Centre d'Etudes de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Technologie des Materiaux); Chapuis, N.; Cartier, F.; Pincemaille, G.; Guenon, Y. CEA Centre d'Etudes de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Technologie des Materiaux. 1992. 5p. (CONF-920463–: 11. international conference and exhibits on NDE in the nuclear and pressure vessel industries, Albuquerque, NM (United States), 29 Apr - 3 may 1992). Order Number DE93721150. Source: OSTI; NTIS (US Sales Only); INIS.

Improved computer technology and technical advances in data analysis have significantly modified the methods employed to perform ultrasonic inspections. The SPARTACUS system developed by the CEA (French Atomic Agency) in an example of this progress. The nerve center of the system is a graphic workstation. The system permits full digitization of waveform while retaining high data acquisition rates of conventional system. In addition, it enables ultra fast analysis with comprehensive interactive imaging including signal processing (filtering, correlation, deconvolution...), image processing, spectrum analysis, automatic edition of report, 3D presentation. This system is now use during In-Service Inspection with MIS (In-Service Inspection Machine). Some examples of applications are shown: improvement in sizing capabilities, examination of austenitic weldments; thickness measurement (tube applications...), automatic detection.

1262 (CEA-CONF–11031) **Improvements of the tubes ut inspection using a rotating probe and data processing.** Gondard, C. (CEA Centre d'Etudes de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Technologie des Materiaux); Roy, O. CEA Centre d'Etudes de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Technologie des Materiaux. 1992. 4p. (CONF-920463–: 11. international conference and exhibits on NDE in the nuclear and pressure vessel industries, Albuquerque, NM (United States), 29 Apr - 3 may 1992). Order Number DE93721151. Source: OSTI; NTIS (US Sales Only); INIS.

An ultrasonic method has been developed to test straight or bend steam generator tubes in power plant. A new type of rotating probes for cracks and wall thickness measurements have been built up and successfully tested. The data acquisition and processing system SPARTACUS is used. It allows high frequency digitalization and powerful signal processing using automatic reporting. The actual performances were tested on natural and artificial defects under representative operating conditions.

1263 (INIS-BR–2936) **Ultrasonic testing X gammagraphy.** Mello Campos, A.M. de (Companhia de Saneamento Basico do Estado de Sao Paulo (SABESP), Sao Paulo, SP (Brazil)). Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). 1989 16p. (In Portuguese). (CONF-8911264–: 9. Brazilian seminar of non destructive testing, Sao Paulo (Brazil), 5-8 Nov 1989). Order Number DE93603789. Source: OSTI; NTIS (US Sales Only); INIS.

The experience of 10 years for substituting gammagraphy tests by ultrasonic tests is related. A comparative evaluation of data obtained from both techniques applied to welded butt joints is presented. (author).

1264 (KAERI/RR–1067/91) **Development of nondestructive testing technology for the pressure boundary components in a nuclear plant.** Park, Day Young (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Lee, Sam Lai; Suh, Dong Man; Sim, Chul Moo; Cheong, Yong Moo; Chung, Tae Eun; Lee, Yun Sang. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Jan 1991. 81p. (In Korean). Order Number DE93605736. Source: OSTI; NTIS (US Sales Only); INIS.

Simulated U-bend of row-1 steam generator tubings have been fabricated with draw bending technique. Eddy current signals from artificial defects on the tubings using MRPC (Motorized Rotating Pancake Coil) have been analyzed. S/N ratio of at least more than 1.5 has been obtained and the optimum frequency has been determined as 100kHz. In order to develop the EMAT (Electro-Magnetic Acoustic Transducer) equivalent circuit has been characterized and design para-meters have been determined. Elongated spiral shape EMAT's for the S-H wave generation and high energy pulse generation device made of serial capacitors and SCR have been fabricated. A computer program for reconstruction of signal amplitudes using SAFT (Synthetic Aperture Focusing Technique) algorithm has been developed. The results of data processing with SAFT method have shown greatly improved S/N ratio. (Author).

1265 (ORNL/ATD–64) **Hydrostatic pressure testing of graphite/epoxy cylinder C6-1.** Blake, H.W.; Starbuck, J.M. Oak Ridge National Lab., TN (United States). Applied Technology Div. Jul 1992. 127p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93000427. Source: OSTI; NTIS; GPO Dep.

This report details the design, fabrication, and testing of IM6 graphite cylinder C6-1, which achieved a record pressure in hydrotest without failure. Included are the details of the cylinder construction, the design calculations for stress and buckling, and the cylinder failure predictions. Also provided are the design details of the metal end closures including the design calculations for the linear tapered end plugs. Finally, the test data and observations from the hydrotest are summarized. This work is performed under the Oak Ridge National Laboratory, Laboratory Directed Research and Development Program. The project is funded by the Director as a three-year project.

1266 (SA-FOU–91-01) **A procedure for safety assessment of components with cracks - Handbook.** Bergman, M.; Brickstad, B.; Dahlberg, L.; Nilsson, F.; Sattari-Far, I. Swedish Plant Inspectorate, Stockholm (Sweden). Dec 1991. 89p. Order Number DE93603790. Source: OSTI; NTIS; INIS.

A procedure for assessment of components with cracks or crack like defects is described in this handbook. The procedure can be used to decide if a certain defect can cause fracture of a component or otherwise be judged detrimental to the safety of the component. It is assumed in the method that the shape and the size of the considered defect are defined. The defect can be an actually existing one or a hypothetical one in connection with damage tolerance assessments. The procedure can be used to estimate: a; The load carrying capacity of the component with consideration of the assumed defect, or b; The maximal crack size that does not cause fracture for the assumed loading conditions. The assessments described under a and b can be performed with or without consideration of safety margins. A system for safety margins is outlined. For application to components in nuclear power facilities numerical values of the safety factors are given. The method that is utilized in this procedure is based on the R6-method, developed at CEGB. The basic assumption is that fracture initiated by a crack can be described by the variables K_R and L_R.

K_R is the ratio between the elastically calculated stress intensity factor and the fracture toughness of the material. L_R is the ratio between applied load and the plastic limit load of the structure. The method can in principal be used for all metallic materials where the material properties σ_Y and K_{cr} can be defined. It is, however, more extensively verified only for steel alloys. The method is not intended for use at so high temperatures that creep deformation is of importance. A computer program written in FORTRAN 77 has been developed which is capable of performing the calculations described in this document.

4210 Combustion Systems

Refer also to citation(s) 82

4220 Mining and Underground Engineering

Refer also to citation(s) 148

1267 **Sealing system for a sealed bearing assembly used in earth drilling.** Wenzel, K.H.; Foote, D. 11 Jul 1992. Filed date 8 Jan 1991. Canada Patent patent application 2033779. 24p. Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN.

An improved sealing system for a sealed bearing assembly used in downhole motor systems for earth drilling is disclosed. The bearing assembly has a first tubular member, and a second tubular member telescopically received in the first member. The second member has an interior passage through which drilling fluids pass under pressure from on-surface pumps. A clearance space is provided between the first and second tubular members defining a lubricant-filled bearing chamber. The improvement of the invention is in the seal at a pump end of the bearing chamber which consists of a first floating piston, a second floating piston spaced from the first, and a fixed seal intermediate the first and second floating pistons. A first chamber filled with lubricant is provided between the first floating piston and the fixed seal. A second chamber is provided between the fixed seal and the second floating piston. The chamber has a passage to a location external of the first tubular member. The differential in pressure between the first and second chambers is sealed by the fixed seal. The system of the invention provides a means for balancing, insofar as possible, the pressures exerted upon individual seals while providing backup seals in the event of seal failure, thereby prolonging the useful life of the bearing assemblies. 3 figs.

4230 Marine Engineering

1268 (NEI-NO–277) **Methods for design and analysis of flexible risers.** Soedahl, N. Trondheim Univ. (Norway). Norges Tekniske Hoegskole. 1991 214p. Order Number DE93721627. Source: OSTI; NTIS.

The main purpose of this work is to improve existing methods for practical design and analysis of flexible pipes used as fully dynamic risers in floating production systems and contribute to a better understanding of the static and dynamic behavior of flexible risers. The design analysis today are often carried out by stochastic time domain simulations for a given short-term environmental condition by use of the finite element method. The responses of flexible risers are known to be non-Gaussian due to the non-linearities introduced by the hydrodynamic loading and the stiffness properties of the pipe. Rather long simulations will therefore be needed to give a proper statistical response description. An efficient method for including bending stiffeners in the design analyses is presented by splitting the complete system into a local quasi-static response model for the bending stiffener analysed by a shooting technique and a global response model to account for the global dynamic behavior. Several case studies have been carried out to verify the accuracy and computational benefit of the proposed approach. A major part of this study has been concerned with extreme value estimation of non-Gaussian respones by fitting a proposed distribution model to a simulated sample of response maxima or response extremes by use of moment-based estimators. The validity of the proposed methods for extreme value estimation and quantification of statistical uncertainties has been investigated by a case study of a steep wave configuration. It is concluded that the derived expressions give a good description of the statistical uncertainty for extreme values estimated by use of the Weibull and the Weibull-tail distributions. 80 refs., 78 figs., 12 tabs.

1269 **Protective system against icebergs or floating objects.** Mogridge, G.R.; Funke, E.R. 13 Jun 1992. Filed date 12 Dec 1990. Canada Patent patent application 2032096. 13p. Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN.

An offshore area such as an oil production platform and associated submarine or floating installations can be protected from drifting icebergs by the use of a system that absorbs the kinetic energy of the object by submerging a buoyant member or members attached to mooring lines anchored to the sea bed in a particular arrangement as described. The system of the invention comprises at least one buoyant member providing a predetermined upward buoyant force upon submergence; and a mooring line attached to each buoyant member and anchored to the sea bed at a position spaced away from the area to be protected. The mooring line has a length sufficient to allow contact of the floating object with the buoyant member or mooring line, and having a length limited to provide travel constraints on the travel path of the buoyant member such that lateral displacement of the line effects downward travel of the buoyant member. The values of the buoyancy force upon submergence and available submergence distance of the buoyant member upon collision with the floating object are selected such that the product of the force and distance equals a value corresponding to a selected portion of the kinetic energy of a predetermined floating object against which protection is desired. 3 figs.

4260 Components, Electron Devices and Circuits

Refer also to citation(s) 1015, 1114, 1117, 1119, 1205, 1288, 1290, 1309, 1337, 1349, 1376, 1400, 1403, 1404, 1452, 1458, 1466, 2392

1270 (BARC–1992/E/005) **Computer control of pulsed tunable dye lasers.** Thattey, S.S. (Bhabha Atomic Research Centre, Bombay (India). Multidisciplinary Research Section); Dongare, A.S.; Suri, B.M.; Nair, L.G. Bhabha Atomic Research Centre, Bombay (India). 1992. 25p. Order Number DE93605896. Source: OSTI; NTIS (US Sales Only); INIS.

Pulsed tunable dye lasers are being used extensively for spectroscopic and photo-chemical experiments, and a system for acquisition and spectral analysis of a volume of data generated will be quite useful. The development of a system for wavelength tuning and control of tunable dye lasers and an acquisition system for spectral data generated in experiments with these lasers are described. With this system, it is possible to control the tuning of three lasers, and acquire data in four channels, simultaneously. It is possible to arrive at the desired dye laser wavelength with a reproducibility of $\pm$ 0.012 cm^{-1}, which is within the absorption width (atomic interaction) caused by pulsed dye lasers of linewidth 0.08 cm^{-1}. The spectroscopic data generated can be analyzed for spectral identification within absolute accuracy $\pm$ 0.012 cm^{-1}. (author). 6 refs., 11 figs.

1271 (CEA-CONF–10977) **A two-frequency Wiggler for a better control of a free-electron-laser dynamics.** Iracane, D.; Bamas, P. CEA Centre d'Etudes de Bruyeres-le-Chatel, 91 (France). 1991. 12p. (CONF-9108118–49: 13. international free-electron laser (FEL) conference, Santa Fe, NM (United States), 25-30 Aug 1991). Order Number DE93721371. Source: OSTI; NTIS (US Sales Only).

In the paper is studied the physics of a free electron laser (FEL) based on a two-frequency undulator (TFU) which induces large non linear effects, especially on the spectral dynamics. These effects are analyzed in an extended formalism where the spontaneous emission, the low-gain regime and the strong-field saturation regime are studied. Numerical simulations show that the optimized

TFU generates a laser field having both a large extraction efficiency and a narrow spectrum.

1272 (DOE/ET/29239–T1) **A basic study of the aging process in solid dielectric cables, Part 1: First annual report, September 29, 1977–October 31, 1978.** Derringer, G.C.; Epstein, M.M.; Gaines, G.B.; Luttinger, M.; McGinniss, V.D.; Thomas, R.E. Battelle Columbus Labs., OH (United States). Nov 1979. 132p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC01-77ET29239. Order Number DE92019747. Source: OSTI; NTIS; GPO Dep.

The Department of Energy, Electrical Energy Systems Division, has initiated a 4-year study concerned with the aging of extruded power transmission cables. The program has two principal objectives: (1) develop a basic understanding of the physical mechanisms of dielectric aging and failures, and (2) develop a nondestructive, accelerated test for predicting the service life of these cables. The program is devoted exclusively to the most widely used solid dielectrics, viz. low density polyethylene, crosslinked polyethylene, and ethylene propylene rubber. For purposes of this program, it is assumed that the cable will be isolated from the external environment during service. The program consists of four sequential tasks, the first two of which are completed. The results of these first two tasks are described in this report. The report also contains an overview of preliminary plans for the third task, a comprehensive experimental program.

1273 (INIS-BR–2933, pp. 252) **Grain measurements in erbium doped fiber.** Souza, E.A. (Universidade Estadual de Campinas, SP (Brazil). Inst. de Fisica); Cruz, C.H.B.; Dini, D.C.; Ayres Neto, J.B.M. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. DOPED MATERIALS/gain; AMPLIFIERS; GAIN; ERBIUM; FIBERS; LASER RADIATION; OPTICAL PUMPING; WAVELENGTHS

1274 (INIS-BR–2933, pp. 262) **Reduction of quantum noise in a micromaser of two resonant non-degenerated photons.** Carvalho, C.R. de (Pontificia Univ. Catolica do Rio de Janeiro, RJ (Brazil). Dept. de Fisica); Maia Neto, P.A.; Davidovich, L. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. QUANTUM EFFICIENCY/ noise; ANALYTICAL SOLUTION; DENSITY MATRIX; MICROWAVE EQUIPMENT; NUMERICAL SOLUTION; PHOTONS; NOISE; RESONANCE

1275 (NEI-NO–284) **Development and control of a resonant dc-link converter for multiple motor drives.** Petterteig, A. Trondheim Univ. (Norway). Norges Tekniske Hoegskole. 1992 217p. Order Number DE93721664. Source: OSTI; NTIS.

This thesis consists of two main parts. In the first part the general resonant dc-link theory, control concepts, and different converter types are presented. The proposed resonant dc-link concept of this work is introduced, as well as its control and some reasons for choosing it. The idea is to use one passively clamped oscillating link with several converters connected. A power circuit simulation program is used for analyzing three passively clamped converters. Finally, the realization of one resonant dc-link converter, and measurements done in the laboratory are described. The second part of the thesis introduces the Insulated Gate Bipolar Transistor (IGBT), which is an important component in this work. The IGBT is a relatively new power transistor. It has found its application field in the voltage range above 300 V dc and the current range above 50 A. 47 refs., 126 figs., 16 tabs.

1276 (SAND–92-0462C) **The use of the charge-induced voltage alteration technique to analyze precursors to dielectric breakdown.** Barton, D.L.; Cole, E.I. Jr. Sandia National Labs., Albuquerque, NM (United States). [1992]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-920971–1: Microelectronic processing, San Jose, CA (United States), 21-25 Sep 1992). Order Number DE92040960. Source: OSTI; NTIS; GPO Dep.

Charge-Induced Voltage Alteration (CIVA) is a new scanning electron microscopy technique to rapidly localize open conductors on integrated circuits (ICs). CIVA uses a constant current source to power the IC under test and produces an image by monitoring the variation in voltage supplied to the IC as a function of electron beam position. This concept of observing supply voltage changes as in CIVA has been applied to Tunneling Current Microscopy (TCM). TCM has been used to localize oxide defects in biased, large area MOS capacitors before oxide breakdown by measuring the fluctuations in current with electron beam position. These changes are normally on the order of 10 nA. Conventional current amplifiers normally limit the applied voltage thereby reducing the operational range of the TCM technique unless special circuit modifications are employed. By using a constant current source and monitoring the voltage changes across the capacitor being analyzed, there are no voltage limitations. Signal magnitudes on the order of 5 mV have been recorded from capacitor defects using the CIVA setup. A detailed description of the CIVA acquisition system used for TCM and a comparison with conventional TCM are provided. Images of oxide defects before breakdown are presented to show that, while the two approaches are comparable wid each has its own strengths and weaknesses, the CIVA approach is a superior technique for precursor localization.

1277 (SAND–92-0650C) **Integrated test and package methods for integrated photonics.** Carson, R.F.; Kravitz, S.H.; Hietala, V.M.; Harff, N.E.; Armendariz, M.G.; Vawter, G.A. Sandia National Labs., Albuquerque, NM (United States). [1992]. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-9209184–4: The International Society for Optical Engineering (SPIE) meeting, Boston, MA (United States), 8-11 Sep 1992). Order Number DE93000748. Source: OSTI; NTIS; GPO Dep.

Arrangements of discrete photonic waveguide devices are currently being integrated to form circuits. These Photonic Integrated Circuits (PICS) require test methods that are adaptable as circuit size and complexity grows. Here, we describe tests used to characterize a GaAs/GaAlAs waveguide-based PIC being developed for phase-shift control in phased-array antenna applications. The various elements of the PIC include digital and analog waveguide modulators, light-guide splitters and combiners, turning mirrors, and input-output polarization-maintaining single-mode optical fibers. These basic elements are combined to perform higher-order functions such as optical frequency translation (single side-band suppressed carrier modulation), and phase shifting on multiple optical taps. Tests used to characterize the elements include optical loss, guided-wave modal characteristics, antireflection coating effectiveness, electro-optical (phase) modulation efficiency, electrical frequency response, and optical frequency translation. These tests are integrated with the fiber attachment and RF packaging sequence to construct working device prototypes. They are currently being applied to discrete components of the circuit, and will be adapted as the various parts are integrated.

1278 (SAND–92-1171C) **Photoconductive semiconductor switches for high power radiation.** Loubriel, G.M. (Sandia National Labs., Albuquerque, NM (United States)); Zutavern, F.J.; Denison, G.J.; Helgeson, W.D.; McLaughlin, D.L.; O'Malley, M.W.; Demarest, J.A. Sandia National Labs., Albuquerque, NM (United States). [1992]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-9210166–1: 4. international conference on ultra-wideband, short-pulse electromagnetics, Brooklyn, NY (United States), 8-10 Oct 1992). Order Number DE92040968. Source: OSTI; NTIS; GPO Dep.

In this paper we present the results of experiments on Si and GaAs Photoconductive Semiconductor Switches (PCSS). Our goal is to improve their performance for high power electromagnetic pulse generation. For Si, we show ways to alter carrier lifetime

achieve higher repetition rates, improvements in switch lifetimes to over 10^7 pulses at high field, and methods that reduce or eliminate thermal runaway and heating. For GaAs, the effects of focused trigger radiation was studied and a further reduction (by a factor of 100) in the required light energy was observed. The gain in these switches is now about 100,000 electrons generated per absorbed or trigger photon. It was further demonstrated that light can be piped through fiber optics to trigger multiple current filaments in GaAs. These results show the ability to control the location of the current filaments.

1279 (SAND–92-1793C) **High efficiency UHF oscillator for portable battery-powered applications.** Wessendorf, K.O. Sandia National Labs., Albuquerque, NM (United States). [1992]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-9209232–1: 14. piezoelectric devices conference, Kansas City, MO (United States), 15-17 Sep 1992). Order Number DE92040961. Source: OSTI; NTIS; GPO Dep.

There is a growing demand for high-frequency circuit designs which are capable of being used in portable battery-powered applications. This type of environment typically requires circuits designed for small size and minimum dc current draw. A transponder design at Sandia National Laboratories required a 430 MHz oscillator (crystal controlled) which could run off a 3 V lithium battery and have an output power of approximately 0 dbm and draw the least possible dc current (less than 4 mA was desired). Physically the oscillator height has to be less than 0.1 in^2 and occupy less than 1 in^2 surface area. Another requirement, for the first engineering prototype, was that the oscillator be made out of inexpensive, standard parts. The design was integrated onto a circuit board with the associated transponder circuitry. This paper describes a technique to make a high-efficiency 430 HHz oscillator which demonstrates efficiencies in the 10% to 12% range for an output of approximately 0 dbm. Data will show the frequency spectrum of the oscillator waveform and the performance of the oscillator over temperature and power supply voltage. To meet the requirements and make the design as simple as possible a 107.5 MHz (R_m < 70 ohms) Statek AT-Strip resonator was chosen. This resonator was chosen because of its small size, surface mountability, and good electrical performance. This resonator was used at series resonance in an oscillator multiplier circuit which would provide a (4X) multiplication in an efficient manner. The oscillator (first stage) is a Butler Oscillator-Multiplier (2X) which is direct coupled to a buffer transistor (second stage) and harmonic generating (2X) transistor which share bias current. The final design delivers 1 dbm at 3 V with 3.33 mA current draw. All harmonics and subharmonics are > 20 db down from the desired frequency.

1280 (SAND–92-1877C) **Revised nomenclature for defects at or near the Si/SiO_2 interface.** Fleetwood, D.M. Sandia National Labs., Albuquerque, NM (United States). [1992]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-921226–3: 1992 Institute of Electrical and Electronic Engineers (IEEE) semiconductor interface specialists conference, San Diego, CA (United States), 9-13 Dec 1992). Order Number DE92040975. Source: OSTI; NTIS; GPO Dep.

A revised nomenclature for defects in MOS devices is described which clearly distinguishes the language used to describe the physical location of defects from that used to describe their electrical response. "Oxide traps" are simply defects in the SiO_2 layer, and "interface traps" are defects at the Si/SiO_2 interface; nothing is presumed about how either communicates with the underlying Si. "Fixed states" are defined electrically as trap levels that do not communicate with the Si on the time scale, but "switching states" can exchange charge with the Si. Fixed states presumably are oxide traps, but switching states can either be interface traps or near-interfacial oxide traps that can communicate with the Si, i.e. "border traps." Thus the term "traps" is reserved for defect location, and the term "states" for electrical response. This defect picture is used to provide new insight into the response of MOS capacitors with 45-nm radiation-hardened oxides to electrical stress and annealing; capacitance-voltage and thermally-stimulated-current measurements are used. 2 figs, 14 refs. (DLC)

1281 (SAND–92-1920C) **Effect of oxide thickness on interface-trap buildup rates.** Shaneyfelt, M.R.; Schwank, J.R.; Fleetwood, D.M.; Winokur, P.S. Sandia National Labs., Albuquerque, NM (United States). [1992]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-921226–1: 1992 Institute of Electrical and Electronic Engineers (IEEE) semiconductor interface specialists conference, San Diego, CA (United States), 9-13 Dec 1992). Order Number DE92040981. Source: OSTI; NTIS; GPO Dep.

The time dependence of radiation-induced interface-trap charge buildup for MOS transistors of varying gate-oxide thickness was investigated in order to clarify how the location of hydrogen in the SiO_2 contributes to N_{it} buildup. Radiation-induced interface-trap buildup in wet and dry gate oxides is compared for irradiations and anneals at constant positive bias and for negative-bias irradiations followed by positive-bias anneals. Implications of these results for different models of interface-trap buildup are discussed. 2 figs, 9 refs. (DLC)

1282 (UCRL-JC–111062) **Time stability of Monte Carlo device simulation: [Extended abstract].** Rambo, P.W.; Denavit, J. Lawrence Livermore National Lab., CA (United States). 29 Jun 1992. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-921204–1: International electron devices meeting, San Francisco, CA (United States), 6-9 Dec 1992). Order Number DE92019375. Source: OSTI; NTIS; GPO Dep.

We present stability analysis applicable to several algorithms used for solid state simulation including an algorithm described by Hackney. An approximate expression for the growth rate, valid for $\omega_p\Delta t<1$ and $\nu_c/\omega_p<1$, is given, by $\gamma\Delta t\approx(\omega_p\Delta t)^2/4-(\nu_c\Delta t)/2$ where ν_c is the momentum transfer collision rate. In the absence of collisions, the interesting result is found that instability occurs for all values of $\omega_p\Delta t$. In practice, collisions allow stable simulation provided $\omega_p\Delta t$ is sufficiently small.

1283 **Method of increasing the efficiency of an electrical generator (combination SIis/E-SIis).** Szabo, L.I. To Electro Erg Ltd. (Hungary). 16 Jul 1992. Filed date 15 Jan 1991. Canada Patent patent application 2034163. 34p. Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN.

A method is disclosed for increasing the efficiency of an electrical generator of the type that generates real output power by a change of the reluctance of the magnetic flux path. The method comprises providing the following components, features, and characteristics of the generator according to a specified formula. The number of turns (N1) of excitation coils of an excitation circuit around the magnetic flux path, the number of turns (N2) of load coils around the magnetic flux path, the number of poles (p) of the reluctance-changing part, the rpm (n) of the reluctance-changing part, the average reluctance of the magnetic flux path (Ra), and the amplitude of change (Rc) of the reluctance of the magnetic flux path are provided in a combination so as to reduce the relative effect of a load (RL ohms) in the load coil according to the equation $[(N1/N2)lex]/[(1/Ra)+(jRL/wN2^2)]$ where $w=2\pi np/60$ and lex is the excitation current. Further aspects of the invention reside in providing methods and means of reducing the effect of the alternating current which is superimposed on the excitation coil, and in providing an electrical generator without a rotor or other moving part of the magnetic flux path of the generator by which the reluctance is changed. 10 figs.

1284 **Method of increasing the efficiency of an electrical generator (SLIS).** Szabo, L.I. To Electro Erg Ltd. (Hungary). 22 Jun 1992. Filed date 21 Dec 1990. Canada Patent patent application 2033013. 18p. Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN.

A method is disclosed for increasing the efficiency of an electrical generator of the type that generates real output power by a change of the reluctance of the magnetic flux path. The method comprises providing the following components, features, and characteristics of the generator according to a specified formula. The number of turns (N1) of excitation coils of an excitation circuit around the magnetic flux path, the number of turns (N2) of load coils around the magnetic flux path, the number of poles (p) on the rotor, the rotor rpm (n), the average reluctance of the flux path

(Ra), and the amplitude of change (Rc) of the reluctance of the magnetic flux path are provided in a combination so as to reduce the relative effect of a load (RL ohms) in the load coil according to the equation $[(N1/N2)/Rc]/[(1/Ra)+(jRL/wN2^2)]$ where $w=2\pi np/60$. Further aspects of the invention reside in providing methods and means of reducing the effect of the alternating current which is superimposed on the excitation coil. 5 figs.

43 PARTICLE ACCELERATORS

Refer also to citation(s) 1985

1285 (ANL/CP–77442) **Design and modeling of superconducting RFQ structures.** Delayen, J.R.; Kennedy, W.L. Argonne National Lab., IL (United States). [1992]. 3p. Sponsored by USDOE, Washington, DC (United States); Department of Defense, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9208109–65: 16. international LINAC conference, Ottawa (Canada), 23-28 Aug 1992). Order Number DE93000511. Source: OSTI; NTIS; GPO Dep.

Tests of the first superconducting RFQ structure indicated that high surface electric fields could be sustained in a quadrupole geometry. However, the geometry used in those tests was not appropriate for an accelerating structure and the area sustaining the high electric field was too small to assume that such fields could be achieved in actual RFQ structures. We have initiated a program to analyze and model a variety of geometries suitable for superconducting RFQ structures. We are also designing a niobium RFQ "sparker" to experimentally measure the surface electric fields that can be achieved on large areas in an actual RFQ structure.

1286 (INIS-BR–2942, pp. 15) **Operation and maintenance of neutron generator.** Souza, M.C.L. (Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Div. de Fisica de Reatores). Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1989. 147p. (In Portuguese). In *Triennial technical report - 1986, 1987, 1988 - Instituto de Engenharia Nuclear (IEN) -Dept. of Reactors (DERE).* Order Number DE93605069. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. NEUTRON GENERATORS/ maintenance; EDUCATION; IRRADIATION; MAINTENANCE; OPERATION

1287 (KAERI/RR–1081/91) **A study on the proton beam irradiation effect in zircaloy using cyclotron.** Han, Jung Ho (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Rheem, Karp Soon; Kim, Young Suk; No, Gae Ho; Jeong, Yong Hwan; Park, Ji Yun; Lee, Duk Hyun; Park, Gi Sung. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Feb 1992. 88p. (In Korean). Order Number DE93605683. Source: OSTI; NTIS (US Sales Only); INIS.

The purpose of this study is to analyze the characteristics of ion beam irradiated zircaloy. The comparison of the characteristic between neutron and ion beam irradiation, and the investigation of the phase transformation mechanism in precipitate of zircaloy are also included for the evaluation of fuel cladding integrity. The results obtained from this study are as follows : (1) Basic studies were performed on the characteristics and correlation between neutron and charged particle irradiation. Amorphization of precipitates under the different types of irradiation was characterized. (2) The microstructural evalution of the unirradiated and proton beam irradiated zircaloy-4 sheet was analyzed. (3) Optimization of proton beam irradiation condition for zircaloy was established by TRIM code. (Author).

1288 (LBL–32734) **Electron beam transport for the LBL IR-FEL.** Staples, J.; Edighoffer, J.; Kim, Kwang-Je. Lawrence Berkeley Lab., CA (United States). Jul 1992. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-9208109–55: 16. international LINAC conference, Ottawa (Canada), 23-28 Aug 1992). Order Number DE93000572. Source: OSTI; NTIS; GPO Dep.

The infrared flee-electron laser (IR-FEL) proposed by LBL as part of the Combustion Dynamics Research Laboratory (CDRL) consists of a multiple-pass accelerator with superconducting cavities supplying a 55 MeV 12 mA beam to an undulator within a 24-meter optical cavity. Future options include deceleration through the same cavities for energy recovery and reducing the power in the beam dump. The electron transport system from the injector through the cavities and undulator must satisfy conditions of high order achromaticity, isochronicity, unity first-order transport matrix around the recirculation loop, variable betatron match into the undulator, ease of operation and economical implementation. This paper presents a workable solution that satisfies these requirements.

4301 Design, Development, and Operation

Refer also to citation(s) 311, 1303, 1395, 1983

1289 (ANL-HEP-CP–92-65) **Argonne Wakefield Accelerator Update '92.** Rosing, M.; Balka, L.; Chojnacki, E.; Gai, W.; Ho, C.; Konecny, R.; Power, J.; Schoessow, P.; Simpson, J. Argonne National Lab., IL (United States). [1992]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9208109–50: 16. international LINAC conference, Ottawa (Canada), 23-28 Aug 1992). Order Number DE92019733. Source: OSTI; NTIS; INIS; GPO Dep.

The Argonne Wakefield Accelerator (AWA) is an experiment designed to test various ideas related to wakefield technology. Construction is now underway for a 100 nC electron beam in December of 1992. This report updates this progress.

1290 (BNL–47856) **Summary of the linac based radiation sources working group.** Ben-Zvi, I.; Corbett, J.; Johnson, E.; Kim, K.J.; Sheffield, R. Brookhaven National Lab., Upton, NY (United States). [1992]. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-9202111–7: 4. generation light sources workshop, Stanford, CA (United States), 24-27 Feb 1992). Order Number DE92041316. Source: OSTI; NTIS; GPO Dep.

Technological advances have occurred in the past few years that have made linac based Free-Electron Lasers (FEL) promising candidates for the generation of short wavelength radiation. Although the FELs use undulators or wigglers, they produce stimulated radiation rather than the spontaneous emission found in insertion devices on the second and third generation sources of today. This stimulated emission process endows the FEL with properties presenting unique opportunities in many fields of science. Among these characteristics are: coherence, spectral brightness, peak power,high average power. Additional scope for experimental growth is provided by the flexible pulse structure of linac based sources, making possible developments in high resolution timing experiments. Invited presentations to the working group on linac based radiation sources covered various key subjects, aiming at establishing the ground work for various machine designs. Design issues of FEL light sources were worked out in a few sessions, including sub-group sessions. We have also discussed the question of R&D necessary for the development of high quality FEL light sources. A high priority was placed on laser photocathode rf gun development, emittance preservation and FEL mechanism studies. This report describes the technological foundation for high brightness beams, the design of FELs using these beams and recommendations for research and development in FEL physics.

1291 (BNL–47857) **A proposed experiment for beam conditioning.** Ben-Zvi, I. (Brookhaven National Lab., Upton, NY (United States)); Yu, L.H.; Govil, R.; Sessler, A.M. Brookhaven National Lab., Upton, NY (United States). [1992]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-9208142–4: 14. international free electron laser conference, Kobe (Japan), 23-28 Aug 1992). Order Number DE92041315. Source: OSTI; NTIS; INIS; GPO Dep.

An experiment on beam conditioning (1) is proposed for the Accelerator Test Facility (ATF) at Brookhaven National Laboratory. The proposed demonstration will employ the already approved Harmonic Generation FEL (2) experiment (HGFEL) at the facility. The HGFEL experiment will use a 30 MeV electron beam from the ATF and a seed laser to produce a 3.4 micron radiation from a

superconducting wiggler with a 1.8 cm period. In the proposed experiment, the beam energy is reduced to 17 MeV, and only the second wiggler of the HGFEL is employed. Resonance is made at 10.6 microns. The demonstration involves spoiling the emittance to drastically reduce the output power. A beam conditioning section introduces momentum variations correlated with betatron amplitude. This correlation will correct the deleterious effects of the artificially introduced emittance increase thus providing a clear demonstration of the conditioner.

1292 (BNL–47909) **Operation of the Brookhaven National Laboratory Accelerator Test Facility.** Batchelor, K.; Ben-Zvi, I.; Botke, I.; Chou, T.S.; Fernow, R.; Fischer, J.; Fisher, A.; Gallardo, J.; Ingold, G.; Malone, R.; Palmer, R.; Parsa, Z.; Pogorelsky, I.; Rogers, J.; Sheehan, J.; Srinivasan-Rao, T.; Tsang, T.; Ulc, S.; van Steenbergen, A.; Wang,Brookhaven National Lab., Upton, NY (United States). [1992]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-9208109–56: 16. international LINAC conference, Ottawa (Canada), 23-28 Aug 1992). Order Number DE93000372. Source: OSTI; NTIS; INIS; GPO Dep.

Early operation of the 50 MeV high brightness electron linac of the Accelerator Test Facility is described along with experimental data. This facility is designed to study new linear acceleration techniques and new radiation sources based on linacs in combination with free electron lasers. The accelerator utilizes a photo-excited, metal cathode, radio frequency electron gun followed by two travelling wave accelerating sections and an Experimental Hall for the study program.

1293 (CEA-LNS-GT–92-05) **The future machine with electrons of 15-30 GeV.** Tkatchenko, A. Laboratoire National Saturne, Centre d'Etudes de Saclay, 91 - Gif-sur-Yvette (France). 1992. 8p. (In French). (CONF-9205256–: 6th SATURNE days, Mont Sainte-Odile (France), 18-22 May 1992). Order Number DE93720980. Source: OSTI; NTIS (US Sales Only); INIS.

This article presents the project of european linear accelerator with a continuous beam of high energy electrons for the Nuclear Physics researches. Based on a superconducting linear accelerator crossed several times, this machine will be able to produce beams of 15 GeV in a first time, then 30 GeV, by increasing of accelerator cavity field without modifying the beam circulation system.

1294 (CRN-VIV–96) **Vivitron - Progress report 1990.** Strasbourg-1 Univ., 67 (France). Centre de Recherches Nucleaires. 1991. 57p. (In French). Order Number DE93721000. Source: OSTI; NTIS (US Sales Only); INIS.

The 1990 activity report of the Strasbourg Nuclear Research, concerning the Vivitron project, is presented. After having mounted all the Van de Graaff elements of the Vivitron needed for the generator tests, the tank was closed in July 1990. It was then put under vacuum, leaks were searched for and repaired. Voltage tests started in December and a voltage of 17.6 MV was reached in February. Modifications on the charging system and to improvement of the column protection against sparks are necessary before the voltage tests can be carried on. Great progress has been made in the setting up of the new Vivitron injector and analysing magnet. In this report are included the description of project different development steps, the Vivitron budget and the list of publications, congress contributions and internal reports. 18 figs.

1295 (DOE/ER/40669–2) **Inverse Free Electron Laser beat-wave accelerator research: Annual progress report.** Marshall, T.C.; Bhattacharjee, A. Columbia Univ., New York, NY (United States). Aug 1992. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-91ER40669. Order Number DE93002770. Source: OSTI; NTIS; INIS; GPO Dep.

In the past twelve-month period, we have completed our experimental study of the inverse-FEL autoaccelerator. The IFEL accelerates electrons by stimulated absorption of a laser pulse passing along an electron beam in an undulator; the autoaccelerator is a configuration we have developed at Columbia to test the principle of resonant absorption and acceleration. This report discusses the progress of this research.

1296 (KAERI/RR–1074/91) **Studies on the improvement of irradiation process.** Kim, Ki Yup (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Pyun, Hyung Chick; Yoon, Byung Mok; Nho, Young Chang; Lee, Young Keun; Park, Soon Chul; Na, Bong Joo; Yoo, Young Soo. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Jan 1991. 94p. (In Korean). Order Number DE93605685. Source: OSTI; NTIS (US Sales Only); INIS.

On the basis of analysis and examination for efficient maintenance and operation of the facility, the method of improving irradiation process was discussed so that we may extend the applicability of irradiation technique to various materials and accelerate nation-wide propagation of radiation processing technology. Preparations have been made for transfer, installation, and operation of the irradiation facilities in radiation application building which will be completed at the headquarter site by the end of 1992. The qualification testing apparatus for nuclear power station cables was conceptually designed to investigate the degradation behavior of the cables under a simulated LOCA(Loss of Coolant Accident) environments. (Author).

1297 (LA-UR–92-2968) **Superconducting RFQ development at Los Alamos.** Wangler, T.P.; Cimabue, A.; Merson, J.; Mills, R.S.; Wood, R.; Young, L. Los Alamos National Lab., NM (United States). [1992]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-9208109–53: 16. international LINAC conference, Ottawa (Canada), 23-28 Aug 1992). Order Number DE93000688. Source: OSTI; NTIS; GPO Dep.

We are investigating the performance capabilities of a niobium, superconducting, radiofrequency-quadrupole (RFQ) accelerator for high- field continuous-wave operation, to provide greater acceleration and stronger focusing of low-velocity ion beams. We present the results of our RFQ beam-dynamics studies, which test new design methods for increasing the beam transmission, our cavity-design calculations, and some mechanical-design aspects of a short, superconducting RFQ 4-vane prototype structure that will be tested at high fields during the coming year.

1298 (LA-UR–92-3215) **Photocathode electron linac for AFEL.** Wood, R.L.; Young, L.M.; Aikin, D.J.; Clark, W.L.; DePaula, R.F.; Gladwell, C.; Ledford, J.E.; Martinez, F.A.; Stovall, J.E. Los Alamos National Lab., NM (United States). [1992]. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-921116–2: 12. international conference on the application of accelerators in research and industry, Denton, TX (United States), 2-5 Nov 1992). Order Number DE93000875. Source: OSTI; NTIS; INIS; GPO Dep.

A compact, high brightness accelerator was designed and fabricated by Los Alamos National Laboratory for use in the Advanced Free Electron Laser facility. A brazed copper, 1300 MHz, 20 MeV structure is suspended within a thermally insulating vacuum vessel. Integral cooling passages allow introduction of cooling water for normal operation, or liquid nitrogen for cryogenic operation. Its exceptional beam quality is expected to enhance the performance of the FEL experiments planned for the AFEL facility.

1299 (LBL–32250) **Asymmetric PHI factories: A proposed experiment and its technical feasibility.** Eberhard, P.; Chattopadhyay, S. Lawrence Berkeley Lab., CA (United States). Jul 1992. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (ESG–178;CONF-920706–35: International conference on high energy accelerators, Hamburg (Germany), 20-24 Jul 1992). Order Number DE93000579. Source: OSTI; NTIS; INIS; GPO Dep.

We discuss an experiments nd the technical feasibility of the required asymmetric ϕ-factory to test nonlocal quantum mechanics in kaon systems.

1300 (LBL-PUB–3104) **ALS beamlines for independent investigators: A summary of the capabilities and characteristics of beamlines at the ALS.** Lawrence Berkeley Lab., CA (United States). Aug 1992. 52p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. Order Number DE93000629. Source: OSTI; NTIS; INIS; GPO Dep.

There are two mods of conducting research at the ALS: To work as a member of a participating research team (PRT). To work as a member of a participating research team (PRT); to work as an independent investigator; PRTs are responsible for building beamlines, end stations, and, in some cases, insertion devices. Thus, PRT members have privileged access to the ALS. Independent investigators will use beamline facilities made available by PRTs. The purpose of this handbook is to describe these facilities.

1301 (SSCL–582) **Kinematic analysis of Six Strut Support System for super collider components.** Weaver, C.D. (San Diego State Univ., CA (United States). Dept. of Mechanical Engineering). Superconducting Super Collider Lab., Dallas, TX (United States). Aug 1992. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE93002183. Source: OSTI; NTIS; INIS; GPO Dep.

The Superconducting Super Collider will contain two proton beams accelerated to successively higher energies through a series of four boosters. Synchronized r-f wave bursts energize the protons, while thousands of magnets guide and focus their path. For proper operation, each magnet must be aligned to tolerances on the order of 0.1 mm; hence, the support structure upon which these magnets will be located must be capable of providing small movements in all six degrees of freedom. The "Minimally Constrained Six Strut System" is being considered for this task; the struts are adjustable in length by differential threads. This paper discusses magnet alignment, gives a mathematical desciption of the problem, and discusses the rotation of the body vector. A computer program was developed. A sensitivity analysis is given. (DLC)

4302 Beam Dynamics, Field Calculations, and Ion Optics

Refer also to citation(s) 1297, 1383, 1385, 1389, 2390

1302 (AECL–10302) **Beam centring in the Chalk River superconducting cyclotron.** Bigham, C.B.; Ormrod, J.H. Atomic Energy of Canada Ltd., Chalk River, ON (Canada). Chalk River Nuclear Labs. Nov 1990. 55p. Order Number DE93603776. Source: OSTI; NTIS (US Sales Only); INIS.

Beams accelerated in the Chalk River superconducting cyclotron can have trajectories throughout the accelerated region that are decentred. This decentring can be causes by incorrect parameters at injection, asymmetrical accelerating voltages or a first harmonic component in the midplane induction. These caused are discussed in detail and methods to correct the trajectories are described. Examples of turn patterns decentred by magnetic first harmonics are given, as well as the techniques used to improve the centring. (38 figs., 4 tabs., 9 refs.).

1303 (AECL–10583) **The acceleration of particles by relativistic electron plasma waves driven by the optical mixing of laser light in a plasma.** Ebrahim, N.A.; Douglas, S.R. Atomic Energy of Canada Ltd., Chalk River, ON (Canada). Chalk River Nuclear Labs. Mar 1992. 66p. Order Number DE93603777. Source: OSTI; NTIS (US Sales Only); INIS.

Electron acceleration by relativistic large-amplitude electron plasma waves is studied by theory and particle simulations. The maximum acceleration that can be obtained from this process depends on many different factors. This report presents a study of how these various factors impact on the acceleration mechanism. Although particular reference is made to the laser plasma beat-wave concept, the study is equally relevant to the acceleration of particles in the plasma wakefield accelerator and the laser wakefield accelerator.

1304 (ANL/CP–77399) **Transverse phase-space evolution in non-stationary charged particle beams.** Bohn, C.L. Argonne National Lab., IL (United States). [1992]. 4p. Sponsored by USDOE, Washington, DC (United States); Department of Defense, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9208109–59: 16. international LINAC conference, Ottawa (Canada), 23-28 Aug 1992). Order Number DE93000618. Source: OSTI; NTIS; INIS; GPO Dep.

The transverse dynamics of a nonrelativistic, mismatched, one-dimensional sheet beam propagating through a continuous, linear focusing channel is investigated. The investigation is based on the Fokker-Planck equation in which the relaxation rate and diffusion coefficient are calculated from a simple model of turbulence resulting from charge redistribution.

1305 (ANL/CP–77445) **Influence of a distribution of deflecting-mode frequencies on the transient dynamics of cumulative beam breakup.** Bohn, C.L.; Delayen, J.R. Argonne National Lab., IL (United States). [1992]. 3p. Sponsored by USDOE, Washington, DC (United States); Department of Defense, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9208109–57: 16. international LINAC conference, Ottawa (Canada), 23-28 Aug 1992). Order Number DE93000616. Source: OSTI; NTIS; INIS; GPO Dep.

A distribution of deflecting-mode frequencies in the constituent cavities of a linear accelerator can lead to Q-independent damping of cumulative beam breakup. A probability density for the deflecting-mode frequencies generates an effective transverse wake function. The effective wake function can be used to calculate the transient dynamics of cumulative beam breakup within the framework of a continuum approximation provided the transverse beam displacement changes little over the correlation length of the deflecting-mode frequencies as the beam moves down the linac. We adopt this approach to show that the damping induced by the effective wake function causes the rate of approach to the steady state to depend strongly on the operative probability density for the deflecting-mode frequencies.

1306 (ANL/CP–77446) **Investigation of alternating-phase focusing for superconducting linacs.** Sagalovsky, L.; Delayen, J.R. Argonne National Lab., IL (United States). [1992]. 4p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9208109–60: 16. international LINAC conference, Ottawa (Canada), 23-28 Aug 1992). Order Number DE93000507. Source: OSTI; NTIS; INIS; GPO Dep.

The paper describes a new model of alternating-phase focusing (APF) dynamics applicable to ion linacs with short independently controlled superconducting cavities. The equations of motion are derived for a cylindrically symmetric electric field represented by a traveling wave with continuous periodic phase modulation. solutions are obtained and analyzed for both the linear and nonlinear particle motion. Problems of linear stability and overall longitudinal acceptance are solved using standard mathematical techniques for periodic systems; analytical results are obtained. It is shown that the main beam dynamical aspects of APF are adequately described by four parameters: equilibrium synchronous phase, phase modulation amplitude, length of APF period, and incremental energy gain. The model can be applied to study the feasibility of realizing APF in a low-β section of a proton linac.

1307 (BNL–47601) **Correcting field harmonics after design in superconducting magnets.** Gupta, R.C. Brookhaven National Lab., Upton, NY (United States). [1992]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-920331–55: International industrial symposium on the super collider, New Orleans, LA (United States), 4-6 Mar 1992). Order Number DE92041311. Source: OSTI; NTIS; INIS; GPO Dep.

For a variety of reasons the actual field harmonics, as measured, in the superconducting magnets come out to be somewhat different than what were intended at the time of design. In this paper we shall discuss the schemes which can be used to correct them in the magnets. We shall discuss them for both the allowed and non-allowed harmonics. Since the deviation in field harmonics from their design value is mainly related to the mechanical properties of the coil cross section, in order for a scheme to work as planned, the mechanical configuration of the coil should not be changed significantly while this correction is being implemented.

1308 (BNL–47948) **Polarized protons at RHIC.** Makdisi, Y. Brookhaven National Lab., Upton, NY (United States). [1992]. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-9201107–3: Adriatico research conference on polarization dynamics in nuclear and particle physics, Trieste (Italy), 7-10 Jan 1992). Order Number DE93001432. Source: OSTI; NTIS; INIS; GPO Dep.

The approval for construction of the Relativistic Heavy Ion Collider (RHIC) provides a potential opportunity to collide polarized proton beams at energies up to 500 GeV in the center of mass and high luminosities approaching $2 \times 10^{32}/cm^2/sec$. This capability is enhanced by the fact that the AGS has already accelerated polarized protons and relies on the newly completed Accumulator/Booster for providing the required polarized proton intensity and a system of spin rotators (Siberian snakes) to retain the polarization. The RHIC Spin Collaboration was formed and submitted a Letter of Intent to construct this polarized collider capability and utilize its physics opportunities. In this presentation, I will discuss the plans to upgrade the AGS, the proposed layout of the RHIC siberian snakes, and timetables. The physics focus is the measurement of the spin dependent parton distributions with such accessible probes including high p(t) jets, direct photons, and Drell Yan. The attainable sensitivities and the progress that has been reached in defining the detector requirements will be outlined.

1309 (BNL–47969) **End effects and orbit correction in the wiggler for the ATF harmonic generation FEL.** Zhang, X.; Ben-Zvi, I.; Ingold, G.; Krinsky, S.; Yu, L.H. Brookhaven National Lab., Upton, NY (United States). [1992]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. Order Number DE93001656. Source: OSTI; NTIS; INIS; GPO Dep.

In this paper, we consider the superconducting wiggler magnet under construction for the High Gain Harmonic Generation experiment (HGHG) at the Accelerator Test Facility (ATF) at BNL. We analyze the effects due to the ends of the wiggler and discuss their correction. In addition, the localized field produced by a trim coil for horizontal beam steering is investigated.

1310 (CEA-LNS-GT-ME–92-03) **Quadrupole error effects in the Arcs.** Nghiem, P. Laboratoire National Saturne, Centre d'Etudes de Saclay, 91 - Gif-sur-Yvette (France). Jan 1992. 8p. Order Number DE93720982. Source: OSTI; NTIS (US Sales Only); INIS.

The purpose of this study is to calculate the R_{56} term of the arcs in order to obtain an integer or a half integer number of phase oscillation for the longitudinal motion in a race-track machine. Considerations concerning cancellation of linac fluctuations in phase or in energy are also presented. Finally, a numerical simulation including effect of non linearities illustrates the differences between the different contemplated cases.

1311 (CEA-LNS-GT-ME–92-05) **Focusing in the LINAC (Phase 1).** Meot, F. Laboratoire National Saturne, Centre d'Etudes de Saclay, 91 - Gif-sur-Yvette (France). Feb 1992. 67p. Order Number DE93720983. Source: OSTI; NTIS (US Sales Only); INIS.

The periodic focusing is provided by a series of 5 a 20 m-long FODO cells (60 in the 1200 m versions), made of 0.3 m long quadrupoles spaced by 9.7 m long straight sections (in which the cavities are installed). The periodic β functions are matched for a 120 degrees phase advance for the first pass through the LINAC. On the second and third passes, the β functions are tuned by varying their initial values at the entrance of the LINAC. Five different versions of the focusing on phase 1 (15 GeV) are presented. The aim is to appreciate the evolution of the β functions and the geometrical acceptance of the LINAC, depending on such parameters as the injection energy, and the arrangement of the cavity free straight sections in the 1200 m long versions. The characteristics of these versions are also presented.

1312 (CEA-LNS-GT-ME–92-06) **Beam transport magnets for the 3-pass race-track machine.** Nghiem, P.; Tkatchenko, A. Laboratoire National Saturne, Centre d'Etudes de Saclay, 91 - Gif-sur-Yvette (France). Mar 1992. 7p. Order Number DE93720985. Source: OSTI; NTIS (US Sales Only); INIS.

The machine is composed of 5 different subsystems: - The linac in which transverse focusing is provided by a periodic structure of FODO cells. - The spreader which separates beams having different energies at the exit of the linac. - The arcs which deflect the beams by 180 deg. - The long straight sections composed of FODO cells which transport the beams from one arc to the next and contain a set of path-length adjustment dipoles (doglegs). - The recombiner which recombines beams of different energies at the linac entrance. A total of 181 main dipoles, 493 quadrupoles, 96 sextupoles and 600 corrector dipoles is necessary to transport the beam through these subsystems. In this paper, the required characteristics of these beam transport magnets are presented.

1313 (CEA-LNS-GT-ME–92-07) **Longitudinal motion in a recirculating machine.** Leleux, G.; Nghiem, P. Laboratoire National Saturne, Centre d'Etudes de Saclay, 91 - Gif-sur-Yvette (France). Mar 1992. 8p. Order Number DE93720984. Source: OSTI; NTIS (US Sales Only); INIS.

The purpose of this study is to calculate the R_{56} term of the arcs in order to obtain an integer or a half integer number of phase oscillation for the longitudinal motion in a race-track machine. Considerations concerning cancellation of linac fluctuations in phase or in energy are also presented. Finally, a numerical simulation including effect of non linearities illustrates the differences between the different contemplated cases.

1314 (CEA-LNS-GT-ME–92-09) **Energy spread, transverse emittance and beam dimensions in the 3-pass race-track machine.** Leleux, G.; Nghiem, P.; Tkatchenko, A. Laboratoire National Saturne, Centre d'Etudes de Saclay, 91 - Gif-sur-Yvette (France). Mar 1992. 31p. Order Number DE93720981. Source: OSTI; NTIS (US Sales Only); INIS.

Energy spread and transverse emittance are calculated in each subsystem (linac, arc, etc... see figure 1) of the 3-pass race-track machine. Knowing optical functions, beam dimensions are estimated. Numerical results are presented for both isochronous and non isochronous cases, in the two following phases: - phase 1 - input energy 500 MeV, output energy 15500 MeV. - Phase 2 - input energy 1000 MeV, output energy 31000 MeV.

1315 (FNAL/C–92/219) **Accelerator physics analysis with an integrated toolkit.** Holt, J.A.; Michelotti, L.; Satogata, T. Fermi National Accelerator Lab., Batavia, IL (United States). Aug 1992. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. (CONF-920706–36: International conference on high energy accelerators, Hamburg (Germany), 20-24 Jul 1992). Order Number DE93000763. Source: OSTI; NTIS; INIS; GPO Dep.

Work is in progress on an integrated software toolkit for linear and nonlinear accelerator design, analysis, and simulation. As a first application, "beamline" and "MXYZPTLK" (differential algebra) class libraries, were used with an X Windows graphics library to build an user-friendly, interactive phase space tracker which, additionally, finds periodic orbits. This program was used to analyse a theoretical lattice which contains octupoles and decapoles to find the 20th order, stable and unstable periodic orbits and to explore the local phase space structure.

1316 (IYaF–91-85) **Microsecond ribbon relativistic electron beam in a plane undulator and generation of microwave radiation.** Arzhannikov, A.V.; Sinitskij, S.L.; Yushkov, M.V. AN SSSR, Novosibirsk (Russian Federation). Inst. Yadernoj Fiziki. 1991. 17p. (In Russian). Order Number DE93605693. Source: OSTI; NTIS (US Sales Only); INIS.

Results of the experiments on transport of the microsecond ribbon REB with some kiloampers current in the plane magnetic undulator at the longitudinal guiding magnetic field were described. Influence of the guiding magnetic field strength on the passing of the beam in the 1 meter undulator and generation of microwave radiation was studied in the experiments. 2 refs.

1317 (IYaF–91-86) **Beam emittance preservation in linear collider VLEPP.** Shil'tsev, V.D. AN SSSR, Novosibirsk (Russian Federation). Inst. Yadernoj Fiziki. 1991. 32p. (In Russian). Order Number DE93605694. Source: OSTI; NTIS (US Sales Only); INIS.

Ways and conditions of obtaining low transverse phase volumes of linear supercollider VLEPP beams are considered. Significance of main factors that can lead to beam emittance growth are estimated. Dynamic techniques of decreasing the emittance growth and methods of collider alignment are investigated. 24 refs.; 7 figs.; 5 tabs.

1318 (JINR-R–9-91-55) **A method for particle tracking through nonlinear fields in synchrotrons.** Shchepunov, V.A. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab.

of High Energy. 1991. 14p. (In Russian). Order Number DE93605697. Source: OSTI; NTIS (US Sales Only); INIS.

A method for the single particle tracking in the 4-dimensional transverse phase space of synchrotrons is considered. The method is based on the numerical construction of the approximately symplectic transformations for phase coordinates. At first coordinates and Jacobi matrices are calculated by means of numerical integration of the equations of motion for some corner points of the 4-dimensional cubic cell in the phase. On this base 4-degree interpolation polynomials transformating coordinates in the approximately symplectic way inside the cell are constructed. Accuracy for the numerical integration method is evaluated through nonsymplecticity measure calculation. The dipole magnets of the JINR nuclotron are used as an example of such evaluations. The method will be useful for the long term tracking studies in the nonlinear fields of synchrotrons and storage rings. 6 refs.; 3 tabs.

1319 (JINR-R–9-91-476) **A stand for measuring the magnetic field of the isochronous cyclotron.** Alenitskij, Yu.G.; Belyaev, A.P.; Chesnov, A.F.; Chesnova, S.I. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems. 1991. 6p. (In Russian). Order Number DE93605695. Source: OSTI; NTIS (US Sales Only); INIS.

A complex of equipment and software for investigation on a model of the magnetic field of isochronous cyclotron U-120I is described. A packet of programs provides the on-line control of the measuring system and the processing of measurement results of the magnetic field. 6 refs.; 3 figs.

1320 (JINR-R–9-91-494) **The resistive instability damper system for the first stage of the UNK accelerator with IIR-filter in feedback.** Zhabitskij, V.M. (Joint Inst. for Nuclear Research, Dubna (Russian Federation)); Korenev, I.L.; Yudin, L.A. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1991. 11p. (In Russian). Order Number DE93605696. Source: OSTI; NTIS (US Sales Only); INIS.

The resistive instability damper system for the coasting beam in the accelerator is discussed. The system for each of two directions of beam transverse coherent oscillations includes two pairs of pick-up electrodes and damping kickers connected by delayed negative feedback. It has been shown that damping regime can be achieved for one and the same pick-up and kicker location independently on imQ. 8 refs.; 4 figs.

1321 (LAL–92-20) **Optics analysis of Final Focus Test Beam with the help of methods based on Lie algebra.** Roy, G. Paris-11 Univ., 91 - Orsay (France). Lab. de l'Accelerateur Lineaire. Apr 1992. 135p. (In French). Order Number DE93721027. Source: OSTI; NTIS (US Sales Only); INIS.

The Final Focus Test Beam being built at SLAC is a test bed for future linear collider final focus systems. The parameters and the optics of the FFTB are presented in chapter one. The mathematical tools for this thesis which are based on Lie algebras are then reviewed in chapter two. One relies particularly on the Lie transformations together with the similarity transformation and the Campbell-Baler-Haussdorff theorem for the manipulation of Hamiltonians. Chapter three presents the application of these methods to magnetic optics in accelerators; the separation of linear and nonlinear effects and the building of the total Hamiltonian of the line from the thin-lens formulation. Chapter four analytically establishes a catalog of aberrations, up to order five in the Hamiltonians, at the FFTB. The emphasis is put on the methods of analysis. It is shown that the system has a significant fifth-order aberration and that no higher-order aberration appears. Finally chapter six presents some stability tolerances - alignment strength and multipole content - for the FFTB. In the conclusion the present situation of these methods, as well as possible computer codes using them, are reviewed.

1322 (LAL-RT–92-09) **A magnet lattice for a tau-charm factory suitable for both standard scheme and monochromatization scheme.** Beloshitsky, P. (Paris-11 Univ., 91 - Orsay (France). Lab. de l'Accelerateur Lineaire). Paris-11 Univ., 91 - Orsay (France). Lab. de l'Accelerateur Lineaire. Jun 1992. 17p. Order Number DE93721702. Source: OSTI; NTIS (US Sales Only); INIS.

A versatile magnet lattice for a tau-charm factory is considered in this report. The main feature of this lattice is the possibility to use it for both standard flat beam scheme and beam monochromatization scheme. The detailed description of the lattice is given. The restrictions following the compatibility of both schemes are discussed.

1323 (LA-UR–92-2768) **Effect of transients on the beam in the Superconducting Supercollider Coupled-Cavity Linac.** Young, L.M.; Nath, S. Los Alamos National Lab., NM (United States). [1992]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-9208109–61: 16. international LINAC conference, Ottawa (Canada), 23-28 Aug 1992). Order Number DE93000790. Source: OSTI; NTIS; INIS; GPO Dep.

Each module of the Superconducting Super Collider (SSC) Coupled-Cavity Linac (CCL) consists of eight tanks (10 accelerating cells each) coupled with bridge couplers. The radio frequency (rf) power drive is in the center of the module at the bridge coupler between the fourth and fifth tanks. In this simulation of the beam dynamics, the rf power is turned on 10 μs before the beam is turned on. This time lapse allows the fields to build up and stabilize before they are required by the beam. When the beam is turned on, the beam loading causes the fields to change. This transient state of the fields together with their effect on the beam is presented. A model has been developed to calculate field distribution throughout the module as a function of time. Beam dynamics simulations were run with the results of this model at several times during the beam pulse. An estimate of the effect of the transients is given by the results of these simulations.

1324 (LBL–31848) **Impedance-based analysis and study of phase sensitivity in slow-wave two-beam accelerators.** Wurtele, J.S. (Massachusetts Inst. of Tech., Cambridge, MA (United States)); Whittum, D.H.; Sessler, A.M. Lawrence Berkeley Lab., CA (United States). Jun 1992. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (ESG–168;CONF-9206194–13: 3. international conference on advances in fusion and processing of glass, New Orleans, LA (United States), 10-12 Jun 1992). Order Number DE93000565. Source: OSTI; NTIS; INIS; GPO Dep.

This paper presents a new formalism which makes the analysis and understanding of both the relativistic klystron (RK) and the standing-wave free-electron laser (SWFEL) two-beam accelerator (TBA) available to a wide audience of accelerator physicists. A "coupling impedance" for both the RK and SWFEWL is introduced, which can include realistic cavity features, such as beam and vacuum ports, in a simple manner. The RK and SWFEL macroparticle equations, which govern the energy and phase evolution of successive bunches in the beam, are of identical form, differing only by multiplicative factors. Expressions are derived for the phase and amplitude sensitivities of the TBA schemes to errors (shot-to-shot jitter) in current and energy. The analysis allows, for the first time, relative comparisons of the RK and the SWFEL TBAs.

1325 (LBL–32222-Exc.) **Conditioner for a helically transported electron beam.** Wang, C. Lawrence Berkeley Lab., CA (United States). May 1992. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (ESG–182;CONF-9206193–11: Advanced accelerator concepts workshop, Port Jefferson, NY (United States), 14-20 Jun 1992). Order Number DE92041169. Source: OSTI; NTIS; INIS; GPO Dep.

The kinetic theory is developed to investigate a conditioner for a helically imported electron beam. Linear expressions for axial velocity spread are derived. Numerical simulation is used to check the theoretical results and examine nonlinear aspects of the conditioning process. The results show that in the linear regime the action of the beam conditioner on a pulsed beam mainly depends on the phase at which the beam enters the conditioner and depends only slightly on the operating wavelength. In the nonlinear regime, however, the action of the conditioner strongly depends on the operating wavelength and only slightly upon the entrance phase. For a properly chosen operating wavelength, a little less than the electron's relativistic cyclotron wavelength, the conditioner can decrease the axial velocity spread of a pulsed beam down to less than one-third of its initial value.

1326 (LBL–32516) **Bench-marking beam-beam simulations using coherent quadrupole effects.** Krishnagopal, S.; Chin,

Y.H. Lawrence Berkeley Lab., CA (United States). Jun 1992. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (ESG–201;ABC–73;CONF-9204126–11: B factories: state of the art in accelerators, detectors, and physics, Stanford, CA (United States), 6-10 Apr 1992). Order Number DE92041168. Source: OSTI; NTIS; INIS; GPO Dep.

Computer simulations are used extensively in the study of the beam-beam interaction. The proliferation of such codes raises the important question of their reliability, and motivates the development of a dependable set of bench-marks. We argue that rather than detailed quantitative comparisons, the ability of different codes to predict the same qualitative physics should be used as a criterion for such bench-marks. We use the striking phenomenon of coherent quadrupole oscillations as one such bench-mark, and demonstrate that our codes do indeed observe this behaviour. We also suggest some other tests that could be used as bench-marks.

1327 (LBL–32561) **Beam-beam issues in asymmetric colliders.** Furman, M.A. Lawrence Berkeley Lab., CA (United States). Jul 1992. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (ESG–205;CONF-9204126–13: B factories: state of the art in accelerators, detectors, and physics; Spring meeting of the American Physical Society, Stanford, CA (United States); Washington, DC (United States), 6-10 Apr 1992; 20-24 apr 1992; CONF-920405–2 Order Number DE93000573. Source: OSTI; NTIS; INIS; GPO Dep.

We discuss generic beam-beam issues for proposed asymmetric e^+- e^- colliders. We illustrate the issues by choosing, as examples, the proposals by Cornell University (CESR-B), KEK, and SLAC/LBL/LLNL (PEP-II).

1328 (LBL–32580) **Common analysis of the relativistic klystron and the standing-wave free-electron laser two-beam accelerator.** Wurtele, J.S. (Massachusetts Inst. of Tech., Cambridge, MA (United States)); Whittum, D.H.; Sessler, A.M. Lawrence Berkeley Lab., CA (United States). Jul 1992. 3p. Sponsored by USDOE, Washington, DC (United States); National Science Foundation, Washington, DC (United States); Japan Society for the Promotion of Science, Tokyo (Japan); National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). DOE Contract AC03-76SF00098 ;FG02-91ER40648. (ESG–208;CONF-920706–37: International conference on high energy accelerators, Hamburg (Germany), 20-24 Jul 1992). Order Number DE92041205. Source: OSTI; NTIS; INIS; GPO Dep.

This paper summarizes a new formalism which makes the analysis and understanding of both the relativistic klystron (RK) and the standing-wave free-electron laser (SWFEL) two-beam accelerator (TBA) available to a wide audience of accelerator physicists. A "coupling impedance" for both the RK and SWFEL is introduced, which can include realistic cavity features, such as beam and vacuum ports, in a simple manner. The RK and SWFEL macroparticle equations, which govern the energy and phase evolution of successive bunches in the beam, are of identical form, differing only by multiplicative factors. The analysis allows, for the first time, a relative comparison of the RF and SWFEL TBAs.

1329 (LBL–32581) **An investigation of coherent quadrupole beam–beam effects.** Krishnagopal, S. (Lawrence Berkeley Lab., CA (United States)); Siemann, R.H. Lawrence Berkeley Lab., CA (United States). Jul 1992. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098 ;AC03-76SF00515. (ESG–207;SLAC-PUB–5869;CONF-920706–34: International conference on high energy accelerators, Hamburg (Germany), 20-24 Jul 1992). Order Number DE92041191. Source: OSTI; NTIS; INIS; GPO Dep.

We use a new simulation technique that allows us to calculate the beam-beam kick from non-Gaussian beams, to discriminate between the predications of two different theoretical models. Our results are in agreement with one of these models. We employ the simulation to better understand the nature of the coherent effects, and to explore their dependence on damping. We discuss the drawbacks in the other model and suggest improvements.

1330 (SLAC–397) **Analysis of the optics of the Final Focus Test Beam using Lie algebra based techniques.** Roy, G.J. Stanford Linear Accelerator Center, Menlo Park, CA (United States). Sep 1992. 135p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00515. Order Number DE93002220. Source: OSTI; NTIS; INIS; GPO Dep.

This report discusses the analysis of the beam optics of the final focus test beam at the Stanford Linear Collider using Lie algebra. (LSP).

1331 (SLAC-PUB–5914) **Beamstrahlung and the QED, QCD backgrounds in linear colliders.** Chen, P. Stanford Linear Accelerator Center, Menlo Park, CA (United States). Sep 1992. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00515. (CONF-9203159–8: 9. international workshop on photon-photon collisions, San Diego, CA (United States), 22-26 Mar 1992). Order Number DE93001821. Source: OSTI; NTIS; INIS; GPO Dep.

The intense radiation, called beamstrahlung, during the collision of e^+e^- beams in a linear collider, is reviewed, with attention to the influence of beam-beam disruption on the beamstrahlung spectrum. We then discuss the various detector backgrounds induced by these hard beamstrahlung photons, as well as the Weiszacker-Williams photon, through various QED and QCD processes, namely the coherent and incoherent e^+e^- pair creation and the hadron production and minijet yields.

1332 (SLAC-PUB–5920) **Using Lie Algebra methods to analytically study non-perturbative effects in beam lines.** Irwin, J. Stanford Linear Accelerator Center, Menlo Park, CA (United States). Jul 1992. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00515. (CONF-920706–38: International conference on high energy accelerators, Hamburg (Germany), 20-24 Jul 1992). Order Number DE93001823. Source: OSTI; NTIS; INIS; GPO Dep.

Non-perturbative effects can arise in beam lines from strong chromatic and nonlinear elements or from large lattice errors. We present a general approach using Lie algebra methods which provides analytic treatment of beam lines with strong elements or large errors. In addition to affording insight into lattice design and performance, these techniques can answer a broad spectrum of tolerance questions without use of numerical simulations. We give several detailed examples.

1333 (SSCL-Preprint–137) **An approximate invariant using Lie algebra.** Garavaglia, T. Superconducting Super Collider Lab., Dallas, TX (United States). Aug 1992. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. (CONF-920837–7: 26. international conference on high energy physics, Dallas, TX (United States), 6-12 Aug 1992). Order Number DE93000564. Source: OSTI; NTIS; INIS; GPO Dep.

An approximate invariant is found for sextupole transverse dynamics. It is represented in terms of the elements of a Lie algebra associated with a sextupole contribution to the time-dependent Hamiltonian for transverse dynamics.

1334 (SSCL-Preprint–138-Rev.1) **Reliability of numerical solutions of a diffusion equation modeling rf noise-induced dilution in particle beams: Revision 1.** Shih, H.J. (Superconducting Super Collider Lab., Dallas, TX (United States)); Schiesser, W.; Ellison, J. Superconducting Super Collider Lab., Dallas, TX (United States). Oct 1992. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. (CONF-9206185–10-Rev.1: 7. International Association of Mathematics and Computer Simulation (IMACS) international conference on computer methods for partial differential equations, New Brunswick, NJ (United States), 22-24 Jun 1992). Order Number DE93000837. Source: OSTI; NTIS; INIS; GPO Dep.

The dilution process in particle beams caused by noise in the rf accelerating system has been modeled using a diffusion equation. Particle tracking can also be undertaken to determine the effects of rf noise, through it is much more computationally extensive than integrating the diffusion equation. In this paper we present the integration results using the Method of Lines (MOL) for certain important classes of noise. We will describe the numerical algorithms in detail, including those that are made to remove anomalous solutions. Reliability of the numerical results will be checked using both

finite-difference and finite-element (Galerkin) methods in discretization and applying the same algorithms to the cases of linear and quadratic diffusion coefficients where exact solutions are known.

4303 Auxiliaries and Components

Refer also to citation(s) 1296, 1307, 1396, 1398, 1432, 1433, 1440, 1812, 1837, 2339, 2340, 2388, 2389

1335 (ANL/CP–75928) **Upgraded phase control system for superconducting low-velocity accelerating structures.** Added, N. (Sao Paulo Univ., SP (Brazil). Dept. de Fisica Nuclear); Clifft, B.E.; Shepard, K.W. Argonne National Lab., IL (United States). [1992]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9208109–48: 16. international LINAC conference, Ottawa (Canada), 23-28 Aug 1992). Order Number DE92041125. Source: OSTI; NTIS; INIS; GPO Dep.

Microphonic-induced fluctuations in the RF eigenfrequency of superconducting (SC) slow-wave structures must be compensated by a fast-tuning system in order to control the RF phase. The tuning system must handle a reactive power proportional to the product of the frequency range and the RF energy content of the Rf cavity. The fast tuner for the SC resonators in the ATLAS heavy-ion linac is a voltage-controlled reactance based on an array of PIN diodes operating immersed in liquid nitrogen. This paper discusses recent upgrades to the ATLAS fast tuner which can now provide as much as 30 KVA of reactive tuning capability with a real RF power loss of less than 300 watts. The design was guided by numerical modeling of all elements of the device. Also discussed is the RF coupler which can couple 30 KW from 77 K tuner to a 42 K resonant cavity with less than 2 W of RF loss into 4.2 K.

1336 (ANL/CP–75930) **Design for a superconducting niobium RFQ structure.** Shepard, K.W.; Kennedy, W.L.; Sagalovsky, L. Argonne National Lab., IL (United States). [1992]. 3p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9208109–49: 16. international LINAC conference, Ottawa (Canada), 23-28 Aug 1992). Order Number DE92041126. Source: OSTI; NTIS; INIS; GPO Dep.

This paper reports a design for a niobium superconducting RFQ operating at 192 Mhz. The structure is of the rod and post type, novel in that each of four rods is supported by two posts oriented radially with respect to the beam axis. Although the geometry has four-fold rotation symmetry, the dipole-quadrupole mode splitting is large, giving good mechanical tolerances. The simplicity of the geometry enables designing for good mechanical stability while minimizing tooling cost for fabrication with niobium. Results of MAFIA numerical modeling, measurements on a copper model, and plans for a beam test are discussed.

1337 (ANL/CP–76108) **Time-resolved electron-beam characterizations with optical transition radiation.** Lumpkin, A.H. (Argonne National Lab., IL (United States)); Wilke, M.D. Argonne National Lab., IL (United States). [1992]. 21p. Sponsored by USDOE, Washington, DC (United States); Department of Defense, Washington, DC (United States). DOE Contract W-31109-ENG-38 ;W-7405-ENG-36. (CONF-9208142–3: 14. international free electron laser conference, Kobe (Japan), 23-28 Aug 1992). Order Number DE92041122. Source: OSTI; NTIS; INIS; GPO Dep.

Time-resolved characterizations of electron beams using optical transition radiation (OTR) as a prompt conversion mechanism have recently been extended on the Los Alamos Free-electron Laser (FEL) facility 40-MeV linac. Two key timescales for rf-linac driven FELs are the micropulse (10 ps) and the macropulse (5 μs to 1 ms). In the past we have used gated, intensified cameras to select a single or few micropulses (25 to 400 ns gate width) out of the pulse train to evaluate submacropulse effects. Recently, we have obtained some of the first measurements of micropulse bunch length (7 to 10 ps) and submacropulse spatial position and profile using OTR and a Hamamatsu streak camera. Additionally, micropulse elongation effects and head-to-tail transverse kicks are reported as a function of charge.

1338 (ANL/CP–76539) **Target thinning using a Saddle Field Ion Source.** Thomas, G.E.; Greene, J.P. Argonne National Lab., IL (United States). [1992]. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-920933–2: 16. world conference of the International Nuclear Target Development Society: nuclear target preparation, Legnaro (Italy), 21-25 Sep 1992). Order Number DE93000613. Source: OSTI; NTIS; INIS; GPO Dep.

A system is described for thinning films using a Saddle Field Ion source to produce targets which are difficult to make by other means. The method used, the beam profile, and characteristics of the various targets thinned are given.

1339 (ANL/CP–77003) **Thermal analysis of the crotch absorber in APS.** Sheng, I.C.; Howell, J. Argonne National Lab., IL (United States). [1992]. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-920792–36: Society of Photo-Optical Instrumentation Engineers (SPIE) international symposium on optical applied science and engineering, San Diego, CA (United States), 19-24 Jul 1992). Order Number DE93000612. Source: OSTI; NTIS; INIS; GPO Dep.

A crotch absorber design for use in the Advanced Photon source (APS) has been proposed and analyzed. the absorber is placed downstream of sectors S2 and S4 in the curved storage ring chamber and will be subjected to a peak power of 120 W/mm^2 per 100mA synchrotron radiation. A beryllium ring is brazed on the GlidCop cooling cylinder in order to diffuse the concentrated bending magnet heating. One concentric water channel and two annular return water channels are arranged in the GlidCop cylinder to enhance the cooling. A Bodner-Partom thermoviscoplastic constitutive equation and a modified Manson-Coffin fatigue relation are proposed to simulate the cyclic thermal loading, as well as to predict the thermal fatigue life of the crotch absorber. Results of temperature and stress using finite element computations are displayed and series of e-beam welder tests and microstructure measurements are reported.

1340 (ANL/CP–77256) **High heat load synchrotron optics.** Mills, D.M. Argonne National Lab., IL (United States). Aug 1992. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-920792–35: Society of Photo-Optical Instrumentation Engineers (SPIE) international symposium on optical applied science and engineering, San Diego, CA (United States), 19-24 Jul 1992). Order Number DE93000602. Source: OSTI; NTIS; INIS; GPO Dep.

Third generation synchrotron radiation sources currently being constructed worldwide will produce x-ray beams of unparalleled power and power density these high heat fluxes coupled with the stringent dimensional requirements of the x-ray optical components pose a prodigious challenge to designers of x-ray optical elements, specifically x-ray mirrors and crystal monochromators. Although certain established techniques for the cooling of high heat flux components can be directly applied to this problem, the thermal management of high heat load x-ray optical components has several unusual aspects that may ultimately lead to unique solutions. This manuscript attempts to summarize the various approaches currently being applied to this undertaking and to point out the areas of research that require further development.

1341 (ANL/CP–77444) **Phase and amplitude stabilization of beam-loaded superconducting resonators.** Delayen, J.R. Argonne National Lab., IL (United States). [1992]. 3p. Sponsored by USDOE, Washington, DC (United States); Department of Defense, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9208109–58: 16. international LINAC conference, Ottawa (Canada), 23-28 Aug 1992). Order Number DE93000617. Source: OSTI; NTIS; INIS; GPO Dep.

A model has been developed to analyze the static and dynamic behavior of superconducting accelerating cavities operated in self-excited loops in the presence of phase and amplitude feedback, ponderomotive effects, and beam loading. This is an extension of an earlier analysis of the stabilization of superconducting cavities which has been the basis of the control system of several superconducting accelerators but did not include beam loading. Conditions have been derived to ensure static and dynamic stability in the presence of ponderomotive effects (coupling between the mechanical and electromagnetic modes of the cavity through the radiation pressure). Expressions for the effect of fluctuations of

cavity frequency and beam amplitude and phase on the cavity-field amplitude and phase and beam-energy gain have been obtained.

1342 (ANL/HEP-CP–92-72) **A high resolution, single bunch, beam profile monitor.** Norem, J. Argonne National Lab., IL (United States). 26 Aug 1992. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9206193–9: Advanced accelerator concepts workshop, Port Jefferson, NY (United States), 14-20 Jun 1992). Order Number DE92041127. Source: OSTI; NTIS; INIS; GPO Dep.

Efficient linear colliders require very small beam spots to produce high luminosities with reasonable input power, which limits the number of electrons which can be accelerated to high energies. The small beams, in turn, require high precision and stability in all accelerator components. Producing, monitoring and maintaining beams of the required quality has been, and will continue to be, difficult. A beam monitoring system which could be used to measure beam profile, size and stability at the final focus of a beamline or collider has been developed and is described here. The system uses nonimaging bremsstrahlung optics. The immediate use for this system would be examining the final focus spot at the SLAC/FFTB. The primary alternatives to this technique are those proposed by P. Chen /J. Buon, which analyses the energy and angular distributions of ion recoils to determine the aspect ratio of the electron bunch, and a method proposed by Shintake, which measures intensity variation of compton backscattered photons as the beam is moved across a pattern of standing waves produced by a laser.

1343 (BNL–46833-Rev.) **Behavior of TPC's in a high particle flux environment.** Etkin, A. (Brookhaven National Lab., Upton, NY (United States)); Eiseman, S.E.; Foley, K.J.; Hackenburg, R.W.; Longacre, R.S.; Love, W.A.; Morris, T.W.; Platner, E.D.; Saulys, A.C.; Lindenbaum, S.J.; Chan, C.S.; Kramer, M.A.; Zhao, K.H.; Zhu, Y.; Hallman,.Brookhaven National Lab., Upton, NY (United States). 8 Jul 1992. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016 ;AC02-83ER40107 ;AS05-81ER40032 ;AC02-76ER03274. (CONF-911106–62-Rev.: 1991 Institute of Electrical and Electronic Engineers (IEEE) nuclear science symposium and medical imaging conference, Santa Fe, NM (United States), 2-9 Nov 1991). Order Number DE92041276. Source: OSTI; NTIS; INIS; GPO Dep.

TPC's (Time Projection Chamber) used in E-810 at the AGS (Alternating Gradient Synchrotron) were exposed to fluxes equivalent to more than 10^7 minimum ionizing particles per second to find if such high fluxes cause gain changes or distortions of the electric field. Initial results of these and other tests are presented and the consequences for the RHIC (Relativistic Heavy Ion collider) TPC-based experiments are discussed.

1344 (BNL–47348) **Pressure measurements in the AGS Booster ultra-high vacuum system.** Gabusi, J.; Geller, J.; Hseuh, H.C.; Mapes, M.; Stattel, P. Brookhaven National Lab., Upton, NY (United States). [1992]. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-9210161–4: 12. international vacuum congress; 8. international conference on solid surfaces, Hague (Netherlands); Hague (Netherlands), 12-16 Oct 1992; 12-16 oct 1992; CONF-9210162–3). Order Number DE93000378. Source: OSTI; NTIS; INIS; GPO Dep.

An average pressure of mid 10^{-11} Torr has been achieved and maintained in the AGS Booster ring vacuum system during its first year of operation. This ultra-high vacuum system is monitored through remote controlled Bayard-Alpert Gauges (BAGs). The characteristics of the pressure measurements with BAGs over the long cable lengths (up to 200 m) and under various accelerator operating conditions will be described. Two types of noise in the pressure readouts have been identified; the electromagnetic interference (EMI) associated with the acceleration cycles of the Booster and the environment noise associated with the temperature of the collector cables. The magnitude of the noise pickup depends on the routing of the collector cables and reaches the equivalent pressure of low 10^{-9} Torr.

1345 (BNL–47453) **BNL volume H^- source research.** Alessi, J.G.; McCafferty, D.; Prelec, K. Brookhaven National Lab., Upton, NY (United States). [1992]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-9208109–54: 16. international LINAC conference, Ottawa (Canada), 23-28 Aug 1992). Order Number DE93000375. Source: OSTI; NTIS; INIS; GPO Dep.

At BNL, work is in progress on the development of a volume production H^- ion source having a toroidally shaped plasma generation region and a conical filter field. With the original, 20 cm diameter source, up to 50 mA of H^- was measured at a current density of 25 mA/cm^2 in pulsed operation. In first results with a version of this source scaled down to 9.7 cm diameter, up to 25 mA of H^- at a current density of 50 mA/cm^2 has been obtained. In both sources the extracted electron current is typically 3–10 times the H^- current.

1346 (BNL–47621) **Recent status of superconductors for accelerator magnets.** Greene, A.F. Brookhaven National Lab., Upton, NY (United States). [1992]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-9206281–2: ICFA workshop on AC superconductivity, Tsukuba (Japan), 23-25 Jun 1992). Order Number DE92041310. Source: OSTI; NTIS; INIS; GPO Dep.

A survey is given of superconductor wire and cable which has been or will be used for construction of dipole magnets for all of the large European and US superconducting accelerator rings. Included is a simplified view of the construction methods and operating requirements of an accelerator dipole magnet, with emphasis on required superconductor performance. The methods of fabricating Nb-Ti superconductors are described, including the critical parameters and materials requirements. The superconductor performance requirements are summarized in an effort to relate why these are important to accelerator designers. Some of the recently observed time dependent effects are covered briefly.

1347 (BNL–47827) **High power picosecond CO_2 laser system for ATF electron accelerator project.** Pogorelsky, I. Brookhaven National Lab., Upton, NY (United States); STI Optronics, Bellevue, WA (United States). [1992]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016 ;AC06-83ER40128. (CONF-9206193–10: Advanced accelerator concepts workshop, Port Jefferson, NY (United States), 14-20 Jun 1992). Order Number DE92040497. Source: OSTI; NTIS; GPO Dep.

A picosecond high power CO_2 laser system is under the operation at the BNL Accelerator Test Facility. The present paper describes its components and the research efforts to meet the requirements for novel laser acceleration techniques to be tested at the ATF.

1348 (BNL–47890) **An adaptive crystal bender for high power synchrotron radiation beams.** Berman, L.E.; Hastings, J.B. Brookhaven National Lab., Upton, NY (United States). [1992]. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-920792–32: Society of Photo-Optical Instrumentation Engineers (SPIE) international symposium on optical applied science and engineering, San Diego, CA (United States), 19-24 Jul 1992). Order Number DE93000376. Source: OSTI; NTIS; INIS; GPO Dep.

Perfect crystal monochromators cannot diffract x-rays efficiently, nor transmit the high source brightness available at synchrotron radiation facilities, unless surface strains within the beam footprint are maintained within a few arcseconds. Insertion devices at existing synchrotron sources already produce x-ray power density levels that can induce surface slope errors of several arcseconds on silicon monochromator crystals at room temperature, no matter how well the crystal is cooled. The power density levels that will be produced by insertion devices at the third-generation sources will be as much as a factor of 100 higher still. One method of restoring ideal x-ray diffraction behavior, while coping with high power levels, involves adaptive compensation of the induced thermal strain field. The design and performance, using the X25 hybrid wiggler beam line at the National Synchrotron Light Source (NSLS), of a silicon crystal bender constructed for this purpose are described.

1349 (BNL–47968) **Design of dispersion section for the ATF harmonic generation FEL.** Zhang, X.; Ben-Zvi, I.; Ingold, G.; Krinsky, S.; Yu, L.H. Brookhaven National Lab., Upton, NY (United States). [1992]. 10p. Sponsored by USDOE, Washington, DC

(United States). DOE Contract AC02-76CH00016. Order Number DE93001655. Source: OSTI; NTIS; INIS; GPO Dep.

We present an analysis of the dispersion magnet for the high gain harmonic generation experiment to be carried out at the Accelerator Test Facility at BNL. The purpose of the dispersion magnet is to convert energy modulation of the electron beam into spatial bunching. For the dispersion magnet, we discuss the physical requirements, analyze the magnetic design, determine the focusing properties, and consider the effect on the FEL gain of departures from idea behavior on the FEL gain.

1350 (CEA-CONF–11041) **Optical discriminator study for the research in particle physics.** Chipaux, R. (CEA Centre d'Etudes de Saclay, 91 - Gif-sur-Yvette (France). Dept. d'Astrophysique, de la Physique des Particules, de la Physique Nucleaire et de l'Instrumentation Associee); Derre, J.; Kochowski, C.; Lemoigne, Y.; Loucatos, S.; Rebourgeard, PCEA Centre d'Etudes de Saclay, 91 - Gif-sur-Yvette (France). Dept. d'Astrophysique, de la Physique des Particules, de la Physique Nucleaire et de l'Instrumentation Associee. 1992. 3p. (In French). (CONF-9201118–: 12. Material days of guided optics, Paris (France), 23-24 Jan 1992). Order Number DE93721697. Source: OSTI; NTIS (US Sales Only); INIS.

The author studies the feasibility of optical discrimination device that would be used for B mesons in an experiment on fixed target in the future LHC collider at CERN. Its principle has been described earlier and it is composed of a thin and spherical crystal, of refraction index $n=\sqrt{2}$. The internal and external surfaces are concentric sphere parts, axed on the target. In these conditions, a relativistic particle generates Cherenkov photons when it crosses the crystal. These photons are emitted with a different angle vs particle trajectory if this particle come directly from the target (impact parameter=0) of if it comes from secondary decay (no-zero impact parameter).

1351 (CRN-VIV–97) **Accident on the gas transfer system.** Heugel, J. Strasbourg-1 Univ., 67 (France). Centre de Recherches Nucleaires. Oct 1991. 31p. (In French). Order Number DE93721010. Source: OSTI; NTIS (US Sales Only); INIS.

An accident has happened on the Vivitron gas transfer system on the 7 th August 1991. This report presents the context, facts and inquiries, analyses the reasons and explains also how the repairing has been effected.

1352 (CRN-VIV–98) **Injector and beam transport system. Progress report at 24th October 1991.** Rebmeister, R. Strasbourg-1 Univ., 67 (France). Centre de Recherches Nucleaires. Oct 1991. 10p. (In French). Order Number DE93721011. Source: OSTI; NTIS (US Sales Only); INIS.

The status report at the 24th October of the construction, assembly and tests of the Vivitron injector and beam transport system is presented.

1353 (CRN-VIV–99) **Beam transfer line to DEMON target.** Rebmeister, R. Strasbourg-1 Univ., 67 (France). Centre de Recherches Nucleaires. Dec 1991. 7p. (In French). Order Number DE93721012. Source: OSTI; NTIS (US Sales Only); INIS.

This short report describes the beam transfer line to DEMON target on Vivitron accelerator: DEMON target situation, DEMON line optic and line working in ordinary and achromatic mode. 5 figs.

1354 (CRN-VIV–101) **Further calculations on the gas transfer system.** Gaudiot, G.; Paulus, N. Strasbourg-1 Univ., 67 (France). Centre de Recherches Nucleaires. Dec 1991. 35p. (In French). Order Number DE93721013. Source: OSTI; NTIS (US Sales Only); INIS.

The purpose of this report is to explain, by calculations, the gaps in the working of gas transfer system elements and specially those of the recirculation and final extraction.

1355 (DOE/ER/45183–8) **Materials research and beam line operation utilizing NSLS: Progress report.** Liedl, G.L. Purdue Univ., Lafayette, IN (United States). Oct 1992. 9p. Sponsored by USDOE, Washington, DC (United States); National Science Foundation, Washington, DC (United States). DOE Contract FG02-85ER45183 ;FG02-84ER45097. Grant DMR-912-0000;Grant DMR-9011069. Order Number DE93002095. Source: OSTI; NTIS; GPO Dep.

MATRIX, a participating research team of Midwest x-ray scattering specialists, continues to operate beam line X-18A at NSLS. Improvements of the beam line continue to be a focus of MATRIX, including simplified control operations and personal computers. Over the past year the full 227 operational days were utilized. Beam line tests and evaluation coupled with eight MATRIX groups combined to use 179 days. General user demand for use of the beam line continues to be strong and four groups were provided 48 operating days. Among the milestones achieved last year is the first quantitative structural study of the early stages of decomposition of supersaturated Al-Li alloys. Another study utilized the beam line to provide new information on distortions of Cu_20 planes in the cuprate superconductors. A third study illustrates the application of an UHV chamber with low temperature capability and in-situ LEED. Experiments on a simple physisorbed film Xe on Ag (111) showed intensity oscillations during layer-by-layer growth analagous to the RHEED oscillations seen in MBE growth. One beam line improvement is the addition of a capability to make measurements out of the scattering plane.

1356 (EGG–10617-5116) **Beam monitor for subnanosecond proton bunches.** Hilko, R.A. (EG and G Energy Measurements, Inc., Los Alamos, NM (United States). Los Alamos Operations); Harper, R.W.; Klingler, Q.C.; Liljestrand, R.P.; Hunt, L.; Rowton, L. EG and G Energy Measurements, Inc., Los Alamos, NM (United States). Los Alamos Operations. [1992]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC08-88NV10617 ;W-7405-ENG-36. (CONF-9209206–2: Symposium of northeastern accelerator personnel (SNEAP), Quebec (Canada), 23-25 Sep 1992; LA-UR–92-3061). Order Number DE93000693. Source: OSTI; NTIS; GPO Dep.

A custom-built device to monitor subnanosecond bunches of protons will provide temporal information on the proton bunch by sensing the electrical field of the proton bunch. This device is called a nonintercepting beam monitor (NIBM) and two have been installed. One sits between the analyzing magnet and switching magnet for the beam lines out of the tandem accelerator of the Ion Beam Facility (EBF) of the Los Alamos National Laboratory (LANL). Another has been placed 2 ft. in front of the target chamber on beamline R3. Each has its own high-bandwidth recording system with oscilloscope display. Critical inspection of the NIBM pulses has led to consistent subnanosecond operation of the tandem.

1357 (FNAL/C–92/95) **SSC 50 mm collider dipole cryostat single tube support post conceptual design and analysis.** Nicol, T.H. Fermi National Accelerator Lab., Batavia, IL (United States). Apr 1992. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. (CONF-920331–57: International industrial symposium on the super collider, New Orleans, LA (United States), 4-6 Mar 1992). Order Number DE93000620. Source: OSTI; NTIS; INIS; GPO Dep.

This report describes the conceptual design for a support post whose function is identical to that of the current reentrant design, which requires very few modifications to surrounding cryostat components, is thermally equivalent to the current 50 mm support post, and is nearly equivalent structurally. The focus of this work is on a design aimed specifically at application in SSC 50 mm collider dipoles, however, the conceptual design presented here is applicable to other cryogenic systems.

1358 (FNAL/C–92/97) **Stress relaxation in SSC 50mm dipole coils.** Rogers, D.; Markley, F. Fermi National Accelerator Lab., Batavia, IL (United States). Apr 1992. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. (CONF-920331–56: International industrial symposium on the super collider, New Orleans, LA (United States), 4-6 Mar 1992). Order Number DE93000619. Source: OSTI; NTIS; INIS; GPO Dep.

We are measuring the stress relaxation of SSC 50mm outer coils with the goal of predicting how much of the coil prestress will be lost while the coils are warehoused between manufacture and cooldown. We manufacture 3 inch (76.2mm) long segments of coil with the same materials and techniques that have been used for

prototype coils. We are running four simultaneous tests in an attempt to separate the contributions of the different coil materials. Test one is a completely insulated coil section where the insulation is the all polyamide system being tested at Brookhaven; test two is a wire stack insulated only with the normal Kapton overwrap; test three is a stack of bare cable; and test four is a completely insulated normal coil section. All, except for the bare cable, include the ground insulation. The insulated coil sections are carefully dried before loading and testing in order to eliminate stress changes due to varying moisture content. The temperature dependence of the stress relaxation is being studied separately. Three companion papers presented at this conference will be: (1) "Temperature dependence of the viscoelastic properties of SSC coil insulation" (2) "Measurement of the elastic modulus of Kapton perpendicular to the plane of the film at room and cryogenic temperatures" (3) "Theoretical methods for creep and stress relaxation studies of SSC coil."

1359 (FNAL/C–92/102) **Theoretical methods for creep and stress relaxation studies of SSC coil.** McAdams, J.; Markley, F. Fermi National Accelerator Lab., Batavia, IL (United States). Apr 1992. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. (CONF-920331–58: International industrial symposium on the super collider, New Orleans, LA (United States), 4-6 Mar 1992). Order Number DE93000621. Source: OSTI; NTIS; INIS; GPO Dep.

Extrapolation of laboratory measurements of SSC coil properties to the actual construction of SSC magnets requires mathematical models of the experimental data. A variety of models were used to approximate the data collected from creep and stress relaxation experiments performed on Kapton film and SSC coil samples. The coefficients for these mathematical models were found by performing a least-squares fit via the program MINUIT. Once the semiempirical expressions for the creep data were found, they were converted to expressions for stress relaxation using an approximate I pn of the Laplace integral relating the two processes. The data sets from creep experiments were also converted directly to stress relaxation data by numeric integration. Both of these methods allow comparison of data from two different methods of measuring viscoelastic properties. Three companion papers presented at this conference will present: Stress relaxation in SSC 50mm dipole coil. Measurement of the elastic modulus of Kapton perpendicular to the plane of the film at room and cryogenic temperatures. Temperature dependence of the viscoelastic properties of SSC coil insulation (Kapton).

1360 (IPNO–91-06) **MACSE CM-2 cryo modulus: IPN calculations and tests of cryostat.** Buhler, S. Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire. 1991. 66p. (In French). Order Number DE93721029. Source: OSTI; NTIS (US Sales Only); INIS.

This report presents the test object of CM-2 MACSE cryo modulus, test facilities, valuations of heat flux, test programs and results. It presents also the study of thermo-acoustic oscillations.

1361 (IPNO–91-07) **Surface temperature measurements on superconducting cavities in superfluid helium.** Fouaidy, T.; Junquera, T.; Caruette, A. Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire. 1991. 30p. (CONF-9108189–: 5. rf superconductivity workshop at DESY, Hamburg (Germany), 19-21 Aug 1991). Order Number DE93721056. Source: OSTI; NTIS (US Sales Only); INIS.

Two thermometry systems have been developed: a scanning thermometer system routinely used for the 1.5 GHz monocell cavity studies and a fixed thermometer array used to investigate spatial surface resistance distribution on various SC removable endplates of a cylindrical TE011mode cavity. Thermometers used in these systems are thermally insulated from the surrounding HeII bath by an epoxy housing ('epoxy'thermometers). Accurate calibration of the fixed thermometers was conducted by using different test cells and the experimental results were compared to model calculations performed with a finite element computational code. Measured thermometer efficiency and linearity are in good agreement with numerical results. Some typical temperature maps of different Nb samples obtained with the TE011 array (40 epoxy thermometers) are discussed. On the basis of numerical modelling results, a new type of thermometer with an improved efficiency has been designed. The thermal insulation against Helium II has been drastically improved by placing the sensitive part of the thermometer in a small vacuum jacket ('vacuum' thermometers). Two main goals have been reached with the first prototypes: improved efficiency by a factor of 2.5 - 3, and a bath temperature dependence of the thermal response in good agreement with the expected Kapitza conductance behaviour. Fitting experimental results with numerical modelling data, allow us to estimate the Kapitza conductance. The obtained values are in good agreement with the previous results reported by several authors using a different measurement method. The 'vacuum' thermometers are currently used on the TE011 mode cavity with Nb and NbTiN plates and the first results are presented.

1362 (IPNO–92-02) **Equipment and working of gas circuit for the 'Empereur' tandem isolation, by sulfur hexafluoride.** Decourt, M.; Le Bervet, L.; Leroy, R.; Mangano, M.; Said, A. Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire. Feb 1992. 20p. (In French). Order Number DE93721018. Source: OSTI; NTIS (US Sales Only); INIS.

This report described the equipment and the working of the circuit gas for the 'Empereur' tandem isolation by sulfur hexafluoride.

1363 (IPNO-T–91-05) **Magnetic study of extraction elements of compact cyclotron beam with AGOR superconducting coils.** Gustafsson, S. Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire. Dec 1991. 182p. (In French). Order Number DE93721032. Source: OSTI; NTIS (US Sales Only); INIS.

The extraction system of the superconducting cyclotrons is normally making a large use of electric extractors followed by magnetostatic elements. The electric field limit initially hoped for (14 MV/m) has been shown to be too optimistic. A more realistic value is around 10 MV/m in the concerned geometries. The first element of the AGOR extraction system is an electrostatic channel where the maximum electric field is limited to 10.5 MV/m. The smaller separation between the internal beam and the extracted beam at the entrance of the first magnetic element is compensated by the replacement of the usual magnetostatic channels with high power electromagnetic channels placed in the reduced space close to the internal beam and where the horizontal position can be adjusted according to the kind of ion accelerated and its energy. The fringing field very close to the channels is controlled with the help of correction coils reducing the perturbations of the internal beam trajectories to an acceptable level.

1364 (IYaF–90-148) **Electric field strength measuring in a megavolt vacuum diode using active Stark spectroscopy.** Knyazev, B.A.; Mel'nikov, P.I.; Chikunov, V.V. AN SSSR, Novosibirsk (Russian Federation). Inst. Yadernoj Fiziki. 1991. 12p. (In Russian). Order Number DE93605716. Source: OSTI; NTIS (US Sales Only); INIS.

Results of measuring the electric field intensity local values depending on time in a high-voltage vacuum diode during an intense electron beam generation are presented. In the experiments conducted at the U-1 100 KY accelerator the voltage on a diode achieves 0.9 MV and the beam current-55 kA under 4.4 μs pulse duration. The experimental results allow one to reconstruct the motion of emission boundaries of cathode and anode plasma. 16 refs.

1365 (IYaF–91-42) **Duoplasmatron with a hollow cold cathode.** Chumakov, S.N.; Shamovskij, V.G. AN SSSR, Novosibirsk (Russian Federation). Inst. Yadernoj Fiziki. 1991. 13p. (In Russian). Order Number DE93605706. Source: OSTI; NTIS (US Sales Only); INIS.

To increase the resource of ion source operation a duoplasmatron design with cold hollow cathode is developed. The duoplasmatron discharge chamber comprises a water-cooled copper anode to which a molybdenum fuse with emission hole (0.8 mm diameter) is sealed in and a hollow copper water-cooled cathode. The cathode design adopted provides for a stable discharge burning and reliable continuous operation of an ion source during 100 hours of continuous operation. 8 refs.; 8 figs.

1366 (IYaF–91-58) **Designing of electromagnetic devices.** Persov, B.Z.; Trakhtenberg, Eh.M. AN SSSR, Novosibirsk (Russian Federation). Inst. Yadernoj Fiziki. 1991. 73p. (In Russian). Order Number DE93605717. Source: OSTI; NTIS (US Sales Only); INIS.

General questions concerning the theory, calculation and designing of electromagnetic devices, including the magnetic field in space and substance, magnetic materials, calculation of basic magnetic circuit parameters etc, are presented. Specific problems related to heat release and heat removal in electromagnetic devices as well as problems of correlation between the device designed and supply source are considered. Methods for calculating and designing electromagnetic devices of different destination-turning magnets; charged particle movement trajectory correctors, tractive electromagnets etc. are described. 35 refs.; 29 figs.; 1 tab.

1367 (IYaF–91-76) **Stabilization of thermal instability of electrodes of a multisilt ion-optical system by means of longitudinal tension.** Davydenko, V.I.; Morozov, I.I. AN SSSR, Novosibirsk (Russian Federation). Inst. Yadernoj Fiziki. 1991. 10p. (In Russian). Order Number DE93605707. Source: OSTI; NTIS (US Sales Only); INIS.

A thermoelastic model of a single electrode of a multiself ion-optical system allowing one to determine the instability region is proposed. Problems of thermal instability stabilization by longitudinal tension of electrodes for ion-optical system of the IK-50 quasistationary proton source are considered. 5 refs.; 2 figs.

1368 (JINR–9-91-457) **Cyclotron ion source with cold hollow cathode.** Vasil'ev, N.V.; Glazov, A.A.; Novikov, D.L. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems. 1991. 4p. (In Russian). Order Number DE93605709. Source: OSTI; NTIS (US Sales Only); INIS.

The results of the development and investigation of the horizontal PIG ion source with the cold hollow cathode are described. This ion source can be used in cyclotrons with a magnet pole gap not less that 60 mm. The desired value of H^- beam extracted from this ion source has been obtained that is quite for cyclotron type accelerators. 6 refs.; 4 figs.

1369 (JINR-R–9-90-547) **Precision monitor of bunched beam intensity.** Zhabitskij, V.M.; Mel'nikov, V.A.; Popov, S.A. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1990. 6p. (In Russian). Order Number DE93605725. Source: OSTI; NTIS (US Sales Only); INIS.

The method of beam intensity measuring for UNK 1 stage is proposed. The intensity may be measured in the bunch and during orbiting with the accuracy $\pm 0.3\%$. The tensor is based on the wide band toroidal current transformer. Synchronization terms are not hard thanks to a special regime of the low level electronics. The down-frequency clipping distortion is compensated by additional measurings and analog processing. The requirements to the transformer transfer function for measuring the bunch intensity of an arbitrary shape are substantiated. 5 refs.; 4 figs.

1370 (JINR-R–9-90-574) **Combined deflector for isochronous cyclotron U-120K.** Borisov, O.N.; Vorozhtsov, S.B.; Dmitrievskij, V.P.; Morozov, N.A.; Chesnov, A.F.; Chesnova, S.I. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems. 1990. 14p. (In Russian). Order Number DE93605715. Source: OSTI; NTIS (US Sales Only); INIS.

The calculations of a system for deflection of a beam from the chamber of isochronous cyclotron U-120K, which accelerates protons (11-40 MeV), deuterons (6-17 MeV) alpha-particles (11-35 MeV) and helium-3 ions (15-45 MeV). are reported. The deflecting channel consists of the electrostatic, electromagnetic, and current sections. The parameters of channel sections, configurations of electrodes, current coils and ferromagnetic plates ensuring the required electric and magnetic fields are given. The calculated beam extraction efficiency is shown to be $\geq 80\%$ for the whole range of the accelerated particles. Beam losses in the channel do not exceed 10%. 7 refs.; 9 figs.; 3 tabs.

1371 (JINR-R–9-91-31) **MIMI - microtron source of multicharged ions.** Shelaev, I.A. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of High Energy. 1991. 11p. (In Russian). Order Number DE93605708. Source: OSTI; NTIS (US Sales Only); INIS.

The conceptual design of a new source of multicharge ions is given. It's possible with the source to get the beam intensity of nuclei with masses A=20-60 in the range up to 10^{12} p/sec in dc mode or 10^{12} p/pulse in the pulse one. 9 refs.; 3 figs.; 1 tab.

1372 (JINR-R–10-91-35) **An autonomous microprocessor system for measurement of betatron oscillation parameters using signal processor.** Ganbat, G.; Glejbman, Eh.M. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1991. 4p. (In Russian). Order Number DE93605723. Source: OSTI; NTIS (US Sales Only); INIS.

The special-purpose microprocessor system for measurement of betatron oscillation parameters of an accelerated particle beam is designed. The unit carried out on the basis of the signal processor TMS 32010 is the main part of the system. The information about betatron oscillation frequency is obtained by the method of the fast Fourier transformation (FFT) of the mass data about a bunch deviation from orbits during revolutions. The dimension of the massif choice can be changed from 16 up to 1024. The total execution time for FFT occupies 70 ms. The system can be used for any research purpose (to elaborate different algorithms of FFT with lesser numbers) and as a Q-monitor. 4 refs.; 2 figs.

1373 (JINR-R–13-90-532) **Stabilized power supply unit for the correcting windings of the iron-current channel at the JINR phasotron.** Akhmanov, V.V.; Batmanova, Eh.K.; Kazakova, G.G.; Kalinichenko, V.V.; Solomnikov, V.P. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems. 1990. 8p. (In Russian). Order Number DE93605714. Source: OSTI; NTIS (US Sales Only); INIS.

A stabilized 3.2 kA, 6 V power supply unit for the correcting winding of the iron-current channel in the beam extraction system of the JINR phasotron is described. The current instability and pulsation are $\approx 10^{-3}$. The unit uses a magneto-modulation current transducer connected to the primary side of the power converter. The transducer is based on the magnetic modulator with bipolar pulsed excitation. The block-diagram of the current transducer and the circuit diagrams of some blocks of the stabilized power supply unit are given. 7 refs.; 5 figs.

1374 (JINR-R–13-90-580) **The multichannel serial-parallel measurement system for slow-changing signals.** Zubareva, A.M.; Kim Zen Srer; Sokolova, N.V.; Subbotin, V.G.; Sukhov, A.M. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Reactions. 1990. 10p. (In Russian). Order Number DE93605724. Source: OSTI; NTIS (US Sales Only); INIS.

A measurement system for the automatic control of parameters of the U-400 accelerator is described. It includes a 16-channel analog multiplexor, a voltage-frequency converter, a counting ratemeter and a control generator. The counting ratemeter has a memory unit in side. The modules are developed in the CAMAC standard. The system provides the measurement of about 100 parameters with 0.1% accuracy for 0.2-0.5 s cycle. 4 refs.; 5 figs.

1375 (LAL–92-11) **Theoretical and experimental studies of hyperfrequency electron guns with high brightness.** Gao, J. Paris-11 Univ., 91 - Orsay (France); Paris-11 Univ., 91 - Orsay (France). Lab. de l'Accelerateur Lineaire. Apr 1992. 233p. (In French). Order Number DE93720938. Source: OSTI; NTIS (US Sales Only); INIS.

A single cavity RF gun with thermionic cathode (LaB_6) was studied and constructed at the Institute of High Energy Physics, Academia Sinica, Beijing, P.R. China. This RF gun was used as the injector of a 30 MeV Linac for the Beijing Free Electron Laser Project. In the experiments the electron back-bombardment effect and another phenomenon connected with cathode temperature were observed. After carefully choosing the operation parameters, this RF gun injector could stably provide electron beams suitable for doing preliminary FEL experiments. Based on the theoretical analysis a computer code (including space charge forces) was written to simulate the dynamics of electrons in this injector. The photocathode RF gun was investigated theoretically and new design criteria were established. Based on these criteria a two decoupled cavities RF gun, using a laser triggered photocathode, has been designed for the 'LAL/Orsay RF gun project', and model cavities have been fabricated. Based on the model cavity measurement results, the

final cavities have been fabricated and measured. Aiming at reducing further the emittance of electron bunches coming out of the second cavity, linear and nonlinear emittance compensating techniques have been proposed. As a new kind of electron injector suitable for FEL and future e^+e^- linear colliders, a travelling wave RF gun has been investigated theoretically and compared with the standing wave RF. Stimulated by the experimental results on the model cavities, several useful analytical formulae have been derived and verified by the experimental results: (1) Analytical formulae for the coupling coefficient β of a cavity-waveguide coupling system. (2) Analytical formulae for the resonant frequency changes due to opening apertures on cavity walls. (3) Analytical formulae for the coupling coefficient k (or group velocity v_g) of forward and backward travelling wave linear accelerators.

1376 (LA-UR–92-2816) **High temperature heat treatment of 3GHz niobium cavities.** Diete, W. (Wuppertal Univ. (Gesamthochschule) (Germany)); Rusnak, B.; Bennett, B.L.; Clark, W.L.; Maggs, R.G.; Shapiro, A.H.; Wright, P.V. Los Alamos National Lab., NM (United States). [1992]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-9208109–62: 16. international LINAC conference, Ottawa (Canada), 23-28 Aug 1992). Order Number DE93000789. Source: OSTI; NTIS; INIS; GPO Dep.

We applied high temperature heat treatment to 3GHz cavities to determine the preparation of niobium cavities using the titanium solid-state gettering process. Some preliminary results showed peak surface electric fields of up to 65MV/m at a Q-factor of 2×10^{10}. We evaluated improvement in the purity of the niobium by measuring the residual resistance ratio (RRR) at 10K. The purest niobium we prepared reached a RRR of 670. To study the potential application to large-scale accelerator structures at lower frequencies, we are testing the possibility of heat treating the cavity half-cells before welding them. Therefore, we investigated the influence of electron beam welding on the RRR of high-purity niobium.

1377 (LA-UR–92-2998) **Radiation damage considerations in a high luminosity collider: The interaction region.** Lee, D.M. Los Alamos National Lab., NM (United States). [1992]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-9111208–3: 19. INFN eloisation project: maximizing luminosity of hadron colliders at 100 TeV, Erice (Italy), 13-19 Nov 1991). Order Number DE93000685. Source: OSTI; NTIS; INIS; GPO Dep.

The interaction region in a high luminosity collider will be a source of radiation for all components in the vicinity and will place stringent requirements on their design. The major components in the vicinity and will place stingent requirements on their design. The major components in the vicinity of the interaction region are the physics detectors that surround the beam pipe and the focusing quadrupole magnets nearby. We will present the radiation levels in such a physics detector and the power in the forward direction that will be deposited in the forward calorimeters and quad magnets. The implications of the levels on a variety of detector components and electronics will be presented. The calculational techniques and limitation will be reviewed.

1378 (LA-UR–92-3017) **Lasing attempts with a microwiggler on the Los Alamos FEL.** Warren, R.W.; O'Shea, P.G.; Bender, S.C.; Carlsten, B.E.; Early, J.W.; Feldman, D.W.; Fortgang, C.M.; Goldstein, J.C.; Schmitt, M.J.; Stein, W.E.; Wilke, M.D.; Zaugg, T.J.; Newnam, B.E.; Sheffield, R.L. Los Alamos National Lab., NM (United States). [1992]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-9208142–5: 14. international free electron laser conference, Kobe (Japan), 23-28 Aug 1992). Order Number DE93000681. Source: OSTI; NTIS; INIS; GPO Dep.

The APEX FEL normally lases near a wavelength of 3μm using a permanent magnet wiggler with a 2.7-cm period and a linear accelerator of 40-MeV energy. Los Alamos National Laboratory is conducting a series of experiments with the goal of lasing at significantly shorter wavelengths with the same accelerator and the same kind of near-concentric resonator, but using a novel pulsed microwiggler of 0.5-cm period capable of generating a peak field of several tesla. We plan to lase on a fundamental wavelength of ~0.8 μm and on the third harmonic at 0.25 μm.

1379 (LA-UR–92-3165) **An intense source of positrons using a low energy proton beam.** Channell, P.J.; Dreicer, H. Los Alamos National Lab., NM (United States). [1992]. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-9206193–12: Advanced accelerator concepts workshop, Port Jefferson, NY (United States), 14-20 Jun 1992). Order Number DE93000697. Source: OSTI; NTIS; INIS; GPO Dep.

An intense source of positrons would make it possible to consider linear collider designs for the flavor factories now being proposed. Such designs might have the advantage of higher luminosity than circular colliders and would also provide an arena for the further development of linear colliders in preparation for the next generation of TeV linear colliders. An intense source of positrons would also make it possible to be more flexible in the design of the next generation of TeV linear colliders. The two conventional sources of positrons now used are electron-beam electroproduction of positrons and reactor-produced β^+-unstable isotopes. Electroproduction sources can be fairly efficient, but suffer from the disadvantages of high capital cost and destruction of the target at higher fluxes. Reactor sources are much more inefficient and have much higher capital costs than electroproduction sources, but might make sense if a reactor already exists at an appropriate site and is principally used for other purposes. In this paper we will show that it should be possible to produce large fluxes of positrons using intense proton beams of modest energy. The basic idea is to use protons from an accelerator rather than neutrons from a reactor to produce β^+-unstable isotopes by the proton capture reaction. Because the targets of a proton beam can be handled more conveniently and much more quickly than insertions in reactors, we are able to consider a larger range of possible targets with shorter decay times than is reasonable for a reactor.

1380 (LA-UR–92-3203) **Accelerator-control-system interface for intelligent power supplies.** Cohen, S. Los Alamos National Lab., NM (United States). [1992]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-920843–1: 3. Institute of Electrical and Electronic Engineers (IEEE) workshop on computers in power electronics, Berkeley, CA (United States), 9-11 Aug 1992). Order Number DE93000863. Source: OSTI; NTIS; INIS; GPO Dep.

A number of high-current high-precision magnet power supplies have been installed at the proton storage ring at the Los Alamos National Laboratory Accelerator Complex. The units replace existing supplies, powering large dipole magnets in the ring. These bending magnets require a high-current supply that is precise and stable. The control and interface design for these power supplies represents a departure from all others on-site. The supplies have sophisticated microprocessor control on-board and communicate with the accelerator control system via RS-422 (serial communications). The units, built by Alpha Scientific Electronics, Hayward, CA use a high-level ASCII control protocol. The low-level "front-end" software used by the accelerator control system has been written to accommodate these new devices. They communicate with the control system through a terminal server port connected to the site-wide ethernet backbone. Details of the software implementation for the analog and digital control of the supplies through the accelerator control system will be presented.

1381 (LBL–30451) **Development of a dc, broad beam, Mevva ion source.** Brown, I.G.; Dickinson, M.R.; Galvin, J.E.; MacGill, R.A. Lawrence Berkeley Lab., CA (United States). Sep 1991. 15p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract AC03-76SF00098. Contract ARO 116-89. (CONF-910943–6: 4. international conference on ion sources, Bensheim (Germany), 30 Sep - 4 oct 1991). Order Number DE92041167. Source: OSTI; NTIS; INIS; GPO Dep.

We are developing an embodiment of metal vapor vacuum arc (Mevva) ion source which will operate dc and have very large area beam. In preliminary testing, a dc titanium ion beam was formed with a current of approximately 0.6 amperes at an extraction voltage of 9kV (about 18 keV ion energy, by virtue of the ion charge state distribution) and using an 18 cm diameter set of multi-aperture. Separately, we have tested and formed beam from a 50 cm diameter (2000 cm_2) set of grids using a pulsed plasma gun.

This configuration appears to be very efficient in terms of plasma utilization, and we have formed beams with diameter 33 cm (FWHM) and ion current up to 7 amperes at an extraction voltage of 50 kV (about 100 keV mean ion energy) and up to 20 amperes peak at the current overshoot part of the beam pulse. Here we describe this Part Of our Mevva development program and summarize the results obtained to-date.

1382 (LBL–32446) **B factory rf system design issues.** Zisman, M.S. Lawrence Berkeley Lab., CA (United States). Jun 1992. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (ESG–195;ABC–72;CONF-9204126–10: B factories: state of the art in accelerators, detectors, and physics, Stanford, CA (United States), 6-10 Apr 1992). Order Number DE92041211. Source: OSTI; NTIS; INIS; GPO Dep.

We discuss the issues of relevance to the design of a B factory RF system. First, the general parameter regime is outlined, and the reasons behind certain commonly made choices are indicated. This regime involves high beam currents, and many relatively short bunches. Next, the physics difficulties associated with coupled-bunch instabilities are described briefly. We then describe in general terms the alternative approaches taken by various B factory designers, the motivation for these choices, and the technical issues raised by them. Technical solutions have been proposed for both the room-temperature and the superconducting RF scenarios, and considerable R&D is being carried out worldwide to confirm and optimize these solutions.

1383 (LBL–32452-Abst.) **End design of the SSC 58 mm High Gradient Quadrupole.** Caspi, S. Lawrence Berkeley Lab., CA (United States). 10 Jun 1992. 27p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (SC-MAG–385). Order Number DE92041190. Source: OSTI; NTIS; INIS; GPO Dep.

The "end" design of the High Gradient Quad. was done with consideration to the integrated field harmonics, the iron contribution, and the maximum field at the conductor. Magnetic analysis was done on the return end only, however the physical dimension of the lead end were determined as well. Using the cross-section of the windings and Cook's program BEND, we generated the physical end windings around the return end. Placing a single wire at the center of each turn the integrated gradient was computed and iterating on the end block spacers the integrated harmonics minimized. The final geometry was then used for more, extensive calculations, such as the field at the conductor and the 3D field harmonics. For this detailed calculation we have placed a single line current at the center of each strand and included the iron contribution ($\mu = \infty$), see Appendix C. With the termination of the iron serving as a reference, the maximum length of the inner and outer layers are 182 mm and 215 mm respectively. The magnetic length of the end was computed from the gradient function A_2 and was found to be 142 mm. In reality we expect the physical length of the end to be somewhat larger, however this should have little or no effect on the magnetic length. The gradient in the straight section is 212.44 T/m at 7000 A and the integrated value of the gradient is -3.01665 E5 (G) in the end region marked by the magnetic length of the end. The respective integrated harmonics for the end 12 pole and 20 pole are -10.6658 (G/CM^4) and 0.7279 (G/cm^8) corresponding to b_6 = 0.351 , b_{10} = -0.024 units. The above was computed from the values of A_2, A_6, and A_{10}.

1384 (LBL–32463) **Sensitivity studies of a standing-wave free-electron laser.** Rangarajan, G.; Sessler, A. Lawrence Berkeley Lab., CA (United States). Jun 1992. 27p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (ESG–197;CONF-9206193–14: Advanced accelerator concepts workshop, Port Jefferson, NY (United States), 14-20 Jun 1992). Order Number DE93000575. Source: OSTI; NTIS; INIS; GPO Dep.

A standing-wave free-electron laser (SWFEL) has been proposed for use in a two-beam accelerator (TBA). We modify the previous one-dimensional discrete cavity model of the SWFEL by introducing drifts between cavities. We also vary the input beam energy as a function of the bunch number. In this new model, we obtain a stable equilibrium solution for a well-bunched beam (even after including all nonlinear terms). We obtain analytic expressions characterizing this equilibrium in the limit of small cavity lengths. We study the dependence of fluctuations in signal phase along the device as a function of detuning, input beam energy, beam length, current errors, and initial signal field amplitude. We are able to find an optimized set of parameters for which the output energy changes by less than 3% across the cavities for a 1% detuning. The maximum change in signal phase is less than 0.12 radians.

1385 (LBL–32468) **Effects of parasitic beam-beam interaction during the injection process at the PEP-II B Factory.** Chin, Y.H. Lawrence Livermore National Lab., CA (United States). Jun 1992. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (ESG–194;CONF-9204126–12: B factories: state of the art in accelerators, detectors, and physics, Stanford, CA (United States), 6-10 Apr 1992). Order Number DE92041171. Source: OSTI; NTIS; INIS; GPO Dep.

This paper is concerned with beam-beam effects during the injection process at the proposed asymmetric SLAC/LBL/LLNL B-Factory, PEP-II. It is shown that the parasitic beam-beam interaction can lead to a significant blowup in the vertical size of the injected beam. Simulation results for the horizontal and the vertical injection schemes are presented, and their performances are studied.

1386 (LBL–32680) **Performance of the LBL AECR source at various frequencies.** Xie, Z.Q.; Lyneis, C.M.; Lundgren, S.A.; Collins, D. Lawrence Berkeley Lab., CA (United States). Jul 1992. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-920741–5: 13 international conference on cyclotrons and their applications, Vancouver (Canada), 6-16 Jul 1992). Order Number DE93000634. Source: OSTI; NTIS; INIS; GPO Dep.

To study the effects of frequency on an electron cyclotron resonance (ECR) ion source, the LBL Advanced ECR ion source (designed to operate at 14 GHz) has been tested at 6.4, 10, and 14 GHz with one plasma chamber (ID = 6.0 cm), a permanent sextuple magnet ("closed sextuple") with a field strength of 0.84 Tesla at the chamber wall, and no radial vacuum pumping. Pure oxygen was used as the running gas for a fair comparison. The source was tested as a single stage, as well as with cold electron injection using an electron gun in place of a conventional microwave-driven first stage. Higher frequency, with a higher axial magnetic field to ensure a closed ECR zone for electron heating, does give better performance. As demonstrated before, at each frequency electron injection led to about a factor of two increase in the high charge state oxygen beam intensity. The 14 GHz performance of the AECR source with the closed sextuple magnet was compared to the "slotted sextuple" (a plasma chamber with radial pumping slots of 7.0-cm dia and a weaker magnet of 0.64 Tesla at the chamber wall). Results show that a stronger sextuple magnet alone does not automatically improve the source performance.

1387 (SSCL–576-Rev.A) **Fully pipelined and programmable Level 1 trigger: Revision A.** Crosetto, D.; Love, L. Superconducting Super Collider Lab., Dallas, TX (United States). Jul 1992. 73p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE93002759. Source: OSTI; NTIS; INIS; GPO Dep.

The types of detectors and the physics involved in present experiments are reaching a level of cost and complexity so great that it is preferable to implement a programmable trigger solution at al levels rather than a system realized with cabled logic. Experience demonstrates that the fine tuning on the trigger is often only achieved after running an experiment and analyzing the first data acquired. Recent advances in technology made real-time programmable algorithms down to the Level 1 trigger feasible. In this report a number of algorithms for the first level trigger have been simulated using one of the most advanced chips available. A fully-pipelined and programmable Level 1 trigger system sustaining a clock rate of 16 ns has been designed based on a modified version of the Data Wave chip.

1388 (SSCL–596) **DCA211 failure analysis report.** Scanlan, R. (Lawrence Berkeley Lab., CA (United States)); Arden, C. Superconducting Super Collider Lab., Dallas, TX (United States). Jun 1992. 36p. Sponsored by USDOE, Washington, DC (United

States). DOE Contract AC35-89ER40486. Order Number DE93002855. Source: OSTI; NTIS; INIS; GPO Dep.

This report contains the findings, conclusions, and recommendations of a committee that was commissioned to investigate the events leading to the burnout of the main power connection to the test stand in dipole magnet DCA211 during tests at Brookhaven National Laboratory (BNL) on April 8, 1992. The report contains an executive summary of the significant findings, conclusions, and recommendations; this summary is followed by a more detailed compilation of reports, calculations, and data that were used by the committee to reach our conclusions.

1389 (SSCL-Preprint–134-Rev.A) **Influence of cable eddy currents on magnetic field harmonics: Revision A.** Ogitsu, T. (Superconducting Super Collider Lab., Dallas, TX (United States)); Zhao, Y.; Akhmetov, A.; Devred, A. Superconducting Super Collider Lab., Dallas, TX (United States). Jul 1992. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. (CONF-9206281–1-Rev.A: ICFA workshop on AC superconductivity, Tsukuba (Japan), 23-25 Jun 1992). Order Number DE92040549. Source: OSTI; NTIS; INIS; GPO Dep.

Several SSC 5-cm-aperture, 15-m-long dipole magnet prototypes exhibit anomalous behavior of their magnetic field harmonics during current ramps at 4 A/s. The anomalies cease when the ramp is stopped and the current is held constant. The magnets also exhibit a dramatic degradation of their quench current as a function of ramp rate, as well as large AC-losses. After reviewing the AC-performance of the anomalous magnets, we develop a model of cable eddy currents, which can simulate the observed field behavior and the measured AC-losses, and which is consistent with the quench start localization of the high ramp-rate quenches.

1390 (SSCL-Preprint–140) **Cold mass mechanical design, quench and mechanical test results for full length 50 mm aperture SSC model dipoles built at BNL.** Goodzeit, C. (Superconducting Super Collider Lab., Dallas, TX (United States)); Radusewicz, P.; Anerella, M.; Cottingham, J.; Ganetis, G.; Garber, M.; Ghosh, A.; Greene, A.; Gupta, R.; Jain, A.; Kahn, S.; Kelly, E.; Morgan, G.; Muratore, J.; Prodell, A.; RSuperconducting Super Collider Lab., Dallas, TX (United States). Jul 1992. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE93000560. Source: OSTI; NTIS; INIS; GPO Dep.

A series of seven 50 mm aperture, 15-meter long dipole magnets was built and assembled at Brookhaven National Laboratory (BNL). Their design embodies features for evaluation for the final selection of the design for the SSC Collider dipole magnets. This paper discusses mechanical design of the cold mass and presents test results such as quench histories and mechanical parameters during construction and testing.

4304 Storage Rings

Refer also to citation(s) 1317

1391 (IYaF–90-135) **Synchrotron radiation sources and development of wigglers and ondulators in Novosibirsk.** Kulipanov, G.N. AN SSSR, Novosibirsk (Russian Federation). Inst. Yadernoj Fiziki. 1991. 40p. (In Russian). Order Number DE93605731. Source: OSTI; NTIS (US Sales Only); INIS.

Characteristics are presented and features of the existing electron and positron storage rings sources. Prospects of SR source development are considered, new project possibilities are discussed: the Sibir-3 based on the 10 GeV energy storage wing and the Sibir-4 based on the 2.4 GeV energy storage ring with superconducting and the ones based on the permanent a magnets are described. Various setup schemes and variants of applying Wigglers and ondulators on synchrotron radiation sources and in a free electron optical klystron are considered. 40 refs.; 11 tabs.

1392 (IYaF–90-142) **Technical solution of the asymmetric B-factory final focus.** Vlasov, A.M.; Dubrovin, A.N.; Zholents, A.A. AN SSSR, Novosibirsk (Russian Federation). Inst. Yadernoj Fiziki. 1991. 21p. (In Russian). Order Number DE93605732. Source: OSTI; NTIS (US Sales Only); INIS.

The paper describes the final beam focusing system of asymmetric 6.5X4.3 GeV B-factory. Principal unit assembling order is given in details. 21 refs.

1393 (IYaF–91-6) **Orbital motion calculation using Lie method in collider nonlinear magnetic field.** Ehjdel'man, Yu.I.; Yakimenko, V.E. AN SSSR, Novosibirsk (Russian Federation). Inst. Yadernoj Fiziki. 1991. 31p. (In Russian). Order Number DE93605733. Source: OSTI; NTIS (US Sales Only); INIS.

The orbital motion calculation using Lie method in collider nonlinear magnetic field Lie operator method to solving the orbital motion equation charge particle in nonlinear field of collider is obtained. The first four orders of orbital motion hamiltonian series are obtained. 6 refs.

1394 (IYaF–91-77) **Physics and engineering of high brightness synchrotron radiation sources - its future.** Kulipanov, G.N.; Mezentsev, N.A.; Skrinskij, A.N. AN SSSR, Novosibirsk (Russian Federation). Inst. Yadernoj Fiziki. 1991. 18p. (In Russian). Order Number DE93605734. Source: OSTI; NTIS (US Sales Only); INIS.

Various tendencies in creating synchrotron radiation sources are discussed. Analysis of various means of increasing the brightness, the choice of which is determined on the base of a compromise between the radiation user requirements on the one hand, and accelerating and economic requirements, on the other. New experimental capabilities of 6-100 GeV storage rings, available, are developed or produced in various countries. Physical and technical problems related to the creation of such storage rings are considered. 10 refs.; 6 figs.; 3 tabs.

1395 (IYaF–91-79) **Damping ring for a linear collider.** Mikhajlichenko, A.A.; Parkhomchuk, V.V. AN SSSR, Novosibirsk (Russian Federation). Inst. Yadernoj Fiziki. 1991. 47p. (In Russian). Order Number DE93605735. Source: OSTI; NTIS (US Sales Only); INIS.

Successful operation of any linear collider requires injection of bunches with minimal transverse emittance. The damping ring is used as injector, where phase volume decreases due to synchrotron radiation. There are lot of investigations about possibilities of obtaining such low emittance bunches in damping rings. In this paper the new results of investigations of high intensity bunches with extremely low vertical emittance is represented. There is shown, that for obtaining small vertical emittance it is necessary to increase the energy of the damping ring compatible to proposed projects. This is necessary due to significant input of Touchek-effect into vertical emittance. 48 refs.; 10 figs.; 2 tabs.

1396 (LBL–32537) **Transverse feedback in a 100 TeV storage ring.** Lambertson, G. Lawrence Berkeley Lab., CA (United States). Jun 1992. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-9211105–1: Maximizing luminosity of hadron colliders at 100 TeV, Erice (Italy), 13-19 Nov 1992). Order Number DE93001571. Source: OSTI; NTIS; INIS; GPO Dep.

The general purpose for a transverse feedback system in the proton collider is to stabilize coherent bunch motions and reduce them to a small amplitude that will result in an acceptable diffusion rate into incoherent motion. Strong instabilities are expected to be caused by the resistive-wall impedance of the beam tubes in pulsed magnets at the low revolution frequency. The feedback must stabilize thousands of coupled-bunch modes. It must also damp excursions of the injected beam and suppress excitations from noise in magnetic fields, in support structures, and in the feedback circuits. It may also be important in combating some beam-beam interaction effects. Damping by synchrotron radiation will be important in the long-term evolution of the emittance, but it is too weak to be a factor in the coherent damping.

44 INSTRUMENTATION

4401 Radiation Instrumentation

Refer also to citation(s) 957, 1343, 1387, 1451, 1719, 1830, 1837, 1838, 1996, 2047, 2101

1397 (ANL/CP–77200) **Comparison of SANS instruments at reactors and pulsed sources.** Thiyagarajan, P. (Argonne National Lab., IL (United States)); Epperson, J.E.; Crawford, R.K.; Carpenter, J.M.; Hjelm, R.P. Jr. Argonne National Lab., IL (United States). [1992]. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9209225–1: International seminar on structural investigation at pulsed neutron sources, Dubna (Russian Federation), 1-4 Sep 1992). Order Number DE92041120. Source: OSTI; NTIS; INIS; GPO Dep.

Small angle neutron scattering is a general purpose technique to study long range fluctuations and hence has been applied in almost every field of science for material characterization. SANS instruments can be built at steady state reactors and at the pulsed neutron sources where time-of-flight (TOF) techniques are used. The steady state instruments usually give data over small q ranges and in order to cover a large q range these instruments have to be reconfigured several times and SANS measurements have to be made. These instruments have provided better resolution and higher data rates within their restricted q ranges until now, but the TOF instruments are now developing to comparable performance. The TOF-SANS instruments, by using a wide band of wavelengths, can cover a wide dynamic q range in a single measurement. This is a big advantage for studying systems that are changing and those which cannot be exactly reproduced. This paper compares the design concepts and performances of these two types of instruments.

1398 (ANL-HEP-TR–92-67) **Response to concerns of the EM review committee.** Hill, N.F.; Guarino, V.; Nasiatka, J. Argonne National Lab., IL (United States). High Energy Physics Div. 1 Aug 1992. 41p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (SDC–92-00299). Order Number DE92041152. Source: OSTI; NTIS; INIS; GPO Dep.

During the technical review of the stacked versus cast Electromagnetic Calorimeter on June 24 at the SSC Laboratory, certain questions were raised about the technical reliability of the cast lead EMC. The committee asked for specific response to the following concerns: (1) Deflections resulting from a structure weakened to accommodate longer shower maximum η strips. (2) Assembly plans and scenarios considering the deflections as outlined in question 1. (3) Compatibility with shower max. (4) Positioning of source tubes. (5) Subsequent to the last review an additional question has been raised about stress levels in the lead/bulkhead connections. We will present responses to each of these questions, and are prepared to answer any additional questions the committee may raise.

1399 (BNL–47329) **High rate, high resolution, two-dimensional gas proportional detectors for x-ray synchrotron radiation experiments.** Smith, G.C.; Yu, B.; Fischer, J.; Radeka, V.; Harder, J.A. Brookhaven National Lab., Upton, NY (United States). Feb 1992. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-920219–6: 6. international wire chamber conference: wire chambers - recent trends and alternative techniques, Vienna (Austria), 17-21 Feb 1992). Order Number DE93001442. Source: OSTI; NTIS; GPO Dep.

Two-dimensional, gas proportional detectors are being developed for use with X-ray synchrotron radiation. Two new types of interpolating cathode structures have been investigated, both of which can operate with a significantly smaller number of readout nodes along each sensing axis than previous cathodes. Lumped parameter delay lines are used as the position encoders. Timing signals from fast, low noise shaping electronics are fed to a new, dual TDC system developed for this purpose. Operating with a clock frequency of 500 MHz, the TDCs have an intrinsic differential non-linearity of 0.1%. The complete system can handle X-ray fluxes in excess of 10^6 per sec without distortion of the position information. A resolution of approximately 100 μm FWHM and differenfial non-linearity of $\pm$4% have been achieved. Application of a detector with active area 10 cm $\times$ 10 cm using synchrotron radiation is described.

1400 (BNL–47906) **The unofficial AMPLEX owner's manual.** Coe, S.D. Brookhaven National Lab., Upton, NY (United States). Aug 1992. 31p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. Order Number DE93001437. Source: OSTI; NTIS; INIS; GPO Dep.

The AMPLEX chip is an AMPlifying multipLEXing, CMOS technology device. It is an analog signal processor, designed at CERN for use with silicon microstrip detectors. However, its application is not limited to conventional microstrips and it is being used in various detector systems. AMPLEX design goals included modest power consumption and reasonable speed. The main drawback of the chip seems to be a lack of documentation. This report will attempt to fill this void by providing a summary of the properties of the AMPLEX chip, a brief synopsis of how it functions, and most importantly an explanation of how to make it operate in a practical circuit. The information in this paper pertains to the application of the AMPLEX chip to microstrip detectors for the electron beam at Brookhaven National Laboratory's Accelerator Test Facility. Detector design was carried out in the Instrumentation Division. Details of the driving circuit and some information on the inner workings of the AMPLEX chip came directly from CERN and from the paper by E. Beuville et al. The author is in no way connected with CERN, nor is he attempting to promote the AMPLEX chip; he is merely interested in making the chip work and in making it easier for others who might wish the same. Some knowledge of the interior of the chip will help in understanding the process of amplifying and shaping signals, so that is where this paper begins.

1401 (CEAC-R–3-91) **Applichation of the sulphate ceric dosimetric in the high doses range.** Prieto Miranda, F. (Instituto de Investigaciones para la Industria Alimenticia, La Habana (Cuba)). Comision de Energia Atomica, La Habana (Cuba). 1991 15p. (In Spanish). Order Number DE93603906. Source: OSTI; NTIS (US Sales Only); INIS.

The ceric-cerous dosimetric system is one of the system more employed in the high dose dosimetry. The spectrophotometric procedure to measure the ceric-concentration is an usual analityc method to determine the absorbed dose. On the other hand, due at increase employ of the irradiation process control. In this paper is realized the ceric-cerous dosimetric calibration in the dose range of 0,6 - 5 kGy and the application in the irradiation process control to differents absorbed dose values.

1402 (CRN–92-31) **Realization of nuclear aggregates detector integrated into 4Π counter at S.I.S.** Tezkratt, R. Strasbourg-1 Univ., 67 (France). Centre de Recherches Nucleaires; Strasbourg-1 Univ., 67 (France). Jun 1992. 118p. (In French). Order Number DE93721014. Source: OSTI; NTIS (US Sales Only); INIS.

A new cluster detector composed of ionization chambers and thin plastic scintillation, has been developed as part of the large 4 PI counter of SIS/ESR, in order to explore central collisions of high energy heavy ions. In the first part are reported the definition, description, theoretical and experimental studies and installation on site of this detector. Its expected response has been investigated with the use of GEANT simulation program. Results are presented and discussed in second part. The efficiency of the track reconstruction with plastic wall has been tested. The excitation function measurement of Au+Au system at 100, 150, 250, 400, 600 and 800 A MeV has been realized. The purpose of the last part is the presentation of the first data acquisition. The cluster gauging and the algorithm development of trajectory reconstitution between the cluster detector and plastic scintillator wall are also presented.

1403 (EGG–10617-4104) **Resolution characteristics of an 18-mm proximity-focused MCPI tube under narrow optical gate conditions.** Behnke, A.; Sammons, T.J. EG and G Energy Measurements, Inc., Pleasanton, CA (United States). Amador Valley Operations. [1992]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC08-88NV10617. (CONF-9209234–1: Society of Photo-Optical Instrumentation Engineers (SPIE) conference, Victoria (Canada), 21-25 Sep 1992). Order Number DE93000692. Source: OSTI; NTIS; GPO Dep.

We have empirically determined that the gating time of an Micro Channel Image Intensifier (MCPI) tube must be about eight times more than the iris time of the tube to prevent spatial resolution degradation. MTF curves were taken under d-c and dynamic gating conditions, from 1.6-μs to 1-ns gate widths on a tube that has an iris time of 1.2 ns. Under d-c conditions, the 50% MTF was 10 lp/mm. At 50% MTF, the resolution remained at 7 lp/mm from 1.6 μs to 20 ns FWHM; when the gate width was reduced to 10 ns, the resolution decreases to 5 lp/mm at 1.2 ns. Test results and the MTF measurement apparatus are discussed.

1404 (EGG–10617-5100) **Millisecond readout CCD camera.** Prokop, M. (EG and G Energy Measurements, Inc., Los Alamos, NM (United States). Los Alamos Operations); McCurnin, T.W.; Stradling, G. EG and G Energy Measurements, Inc., Los Alamos, NM (United States). Los Alamos Operations. [1992]. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC08-88NV10617. (CONF-9209188–5: 20. international congress on high speed photography and photonics, Victoria (Canada), 25-26 Sep 1992). Order Number DE93000694. Source: OSTI; NTIS; GPO Dep.

We have developed a prototype of a fast-scanning CCD readout system to record a 1024 x 256 pixel image and transport the image to a recording station within 1 ms of the experimental event. The system is designed to have a dynamic range of greater than 1000 with adequate sensitivity to read single-electron excitations of a CRT phosphor when amplified by a microchannel plate image intensifier. This readout camera is intended for recording images from oscilloscopes, streak, and framing cameras. The sensor is a custom CCD chip, designed by LORAL Aeroneutronics. This CCD chip is designed with 16 parallel output ports to supply the necessary image transfer speed. The CCD is designed as an interline structure to allow fast clearing of the image and on-chip fast shuttering. Special antiblooming provisions are also included. The camera is designed to be modular and to allow CCD chips of other sizes to be used with minimal reengineering of the camera head.

1405 (GANIL-R–92-07) **Study and implant of a new beam detector at Ganil.** Vignet, J.L. Grand Accelerateur National d'Ions Lourds (GANIL), 14 - Caen (France). 1992. 18p. (In French). Order Number DE93721003. Source: OSTI; NTIS (US Sales Only); INIS.

This report explains the principle, study and installation of a new beam detector implanted at Ganil. This new detector uses the ionization by the beam of residual gas. It is formed of an accelerator (to canalize ions), an amplifier composed of 2 microchannel plates and of localization lattice (strips).

1406 (IN2P3–92-02, pp. 249-308) **Higgs boson detection at hadron colliders.** Froidevaux, D. (European Organization for Nuclear Research, Geneva (Switzerland)). Institut National de Physique Nucleaire et de Physique des Particules (IN2P3), 75 - Paris (France). 1990. (In French). (CONF-9009441–: Summer school of particle physics, Strasbourg (France), 3-7 Sep 1990). In *Where is the Higgs.* 360p. Order Number DE93720939. Source: OSTI; NTIS (US Sales Only); INIS.

This lesson is divided in several parts: a description of future colliders (Large Hadron Collider, Superconducting Super Collider), a study of main Higgs boson decay channels and their background noises (LHC), and finally a survey of experimental consequences of this study for the electron and photon detection at LHC.

1407 (IN2P3–92-02, pp. 309-353) **Radiation detectors at the future p-p collision rings (LHC/SSC).** Mansoulie, B. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Direction des Sciences de la Matiere). Institut National de Physique Nucleaire et de Physique des Particules (IN2P3), 75 - Paris (France). 1990. (In French). (CONF-9009441–: Summer school of particle physics, Strasbourg (France), 3-7 Sep 1990). In *Where is the Higgs.* 360p. Order Number DE93720939. Source: OSTI; NTIS (US Sales Only); INIS.

This lesson is about the technology of future proton collider detectors (conception, realization and use) and about the difficulties encountered (repetition ratio, data quantity and radiation problem). After 3-4 research years, many solutions have been found and are presented.

1408 (INIS-BR–2933, pp. 334) **Superficial passivation of silicon-lithium type semiconductor detector.** Rizzo, P. (Universidade Federal, Rio de Janeiro, RJ (Brazil). Inst. de Fisica); Santos, W.M.S. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. LI-DRIFTED DETECTORS/ crystals; ETCHING; LEAKAGE CURRENT; CRYSTALS; PASSIVATION; SILICON; SURFACES

1409 (INIS-BR–2934, pp. 331-334) **Operation of resistive plastic tubes in proportional regime.** Fauth, A.C. (Consiglio Nazionale delle Ricerche, Turin (Italy). Ist. di Cosmo-Geofisica); D'Ettore Piazzoli, B.; Bencivenni, G. Sociedade Brasileira de Fisica, Rio de Janeiro, RJ (Brazil). 1989. 350p. (In Portuguese). (CONF-8909489–: 10. National Meeting on Physics of Particles and Fields, Itatiaia (Brazil), 20-24 Sep 1989). In *Proceedings of the 10. National Meeting on Physics of Particles and Fields.* Order Number DE93604123. Source: OSTI; NTIS (US Sales Only); INIS.

The extensive air shower detector used by Gran Sasso Laboratory (Italy) is described. The experimental results are presented. (M.C.K.).

1410 (INIS-BR–2934, pp. 335-338) **Use of streamer tubes in cosmic ray experiments.** D'Ettore Piazzoli, B. (Consiglio Nazionale delle Ricerche, Turin (Italy). Ist. di Cosmo-Geofisica); Fauth, A.C.; Mannochi, G.; Anneli, M.; Battistoni, G.; Bencivenni, G.; Campana, P.; Denni, U.; Ninno, G. de; Laurelli, P.; Pichi, P. Sociedade Brasileira de Fisica, Rio de Janeiro, RJ (Brazil). 1989. 350p. (In Portuguese). (CONF-8909489–: 10. National Meeting on Physics of Particles and Fields, Itatiaia (Brazil), 20-24 Sep 1989). In *Proceedings of the 10. National Meeting on Physics of Particles and Fields.* Order Number DE93604123. Source: OSTI; NTIS (US Sales Only); INIS.

The influence of gas composition on charge distribution and operation stability of streamer tube particle detector with cell of 3 x 3 cm^2 was studied. The possibility to use these chambers without continuous circulation of gas was also investigated aiming to use in large detectors for experiments in extensive air showers. (M.C.K.).

1411 (INIS-mf–13349, pp. 10) **Investigating optical properties and dosimetry of commercial plexi layers to substitue imported perspex dosimeters.** Khazemi Movahad, A.A. (Atomic Energy Organization of Iran, Tehran (Iran, Islamic Republic of) Gamma Irradiation Center); Sohrabpour, M. Iranian Physics Society, Teheran (Iran, Islamic Republic of). 1991. 53p. (In Persian). (CONF-9109417–: Iran's physics conference, Isfahan (Iran, Islamic Republic of), 10 Sep 1991). In *Abstract of articles from Iran's physics conference.* Order Number DE93000811. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. PERSPEX/optical properties; ABSORPTION SPECTRA; COMPARATIVE EVALUATIONS; DOSE RATES; DOSE-RESPONSE RELATIONSHIPS; PERSPEX; PMMA; RADIATION DOSES

1412 (INIS-mf–13349, pp. 10) **Applying EGS4 computer code for calculating the efficiency of gamma detectors in borehole testing.** Deldar, S. (Atomic Energy Organization of Iran, Tehran (Iran,Islamic Republic of). Gamma Irradiation Center); Sohrabpour, M.; Raies Ali, Gh. Iranian Physics Society, Teheran (Iran, Islamic Republic of). 1991. 53p. (In Persian). (CONF-9109417–: Iran's physics conference, Isfahan (Iran, Islamic Republic of), 10 Sep 1991). In *Abstract of articles from Iran's physics conference.* Order Number DE93000811. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. GAMMA DETECTION/e codes; EFFICIENCY; MONTE CARLO METHOD; NAI DETECTORS; POINT SOURCES; RESPONSE FUNCTIONS

1413 (INIS-mf–13358, pp. 49) **A high T_c superconducting bolometer.** Katz, M. (Technion-Israel Inst. of Tech., Haifa (Israel). Dept. of Physics); Oppenheim, U.P.; Koren, G. Weizmann Inst. of

Science, Rehovoth (Israel). Dept. of Physics. 1992. 169p. (CONF-9204195--: 1992 Israel Physical Society annual meeting, Rehovot (Israel), 15 Apr 1992). In *Israel physical society 1992 annual meeting: Program and abstracts.* Order Number DE93604079. Source: OSTI; NTIS (US Sales Only); INIS.

Abstract only. BOLOMETERS/high-tc superconductors; BOLOMETERS

1414 (INIS-mf-13358, pp. 116) **Ultra-fast secondary emission X-ray imaging detectors.** Breskin, A. (Weizmann Inst. of Science, Rehovoth (Israel)); Chechick, R.; Acclander, H.; Akkerman, A.; Elkind, V.; Frumkind, I.; Gibrekhterman, A. Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Physics. 1992. 169p. (CONF-9204195--: 1992 Israel Physical Society annual meeting, Rehovot (Israel), 15 Apr 1992). In *Israel physical society 1992 annual meeting: Program and abstracts.* Order Number DE93604079. Source: OSTI; NTIS (US Sales Only); INIS.

Abstract only. X-RAY RADIOGRAPHY/secondary emission detectors; IMAGE CONVERTERS

1415 (IYaF-91-8) **Absolute spectral sensitivity of photodiode arrays in the X-ray energy range 7-20 keV.** Dolbnya, I.P.; Kurylo, S.G. AN SSSR, Novosibirsk (Russian Federation). Inst. Yadernoj Fiziki. 1991. 10p. (In Russian). Order Number DE93605875. Source: OSTI; NTIS (US Sales Only); INIS.

The results of the investigation of absolute spectral sensitivity of an linear photo-diode arrays (the such of kind LF1024-25/2) as an X-ray one-coordinate detectors in the energy range from 7 to 20 keV are presented. The measurements have been carried out with the use synchrotron radiation from VEPP-3M storage ring.

1416 (JINR-13-90-16) **Cast polystyrene plastic scintillator for the hadron calorimeter of the tagged neutrino beam facility.** Kadykov, M.G. (Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of High Energy); Semenov, V.K.; Suzdalev, V.I. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of High Energy. 1990. 5p. (In Russian). Order Number DE93605867. Source: OSTI; NTIS (US Sales Only); INIS.

Submitted to Prib. Tekh. Ehksp.

The fabrication of cast plastic scintillators from polystyrene granules using a pressautomatic machine is described. Characteristics of the cast scintillators are compared to the samples obtained by other techniques. The results of the comparison demonstrate a high quality of the scintillator plates produced by the casting technique. 8 refs.; 3 figs.; 1 tab.

1417 (JINR-13-90-236) **Comparative characteristics of polystyrene strips with different scintillation fraction.** Gapienko, V.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (Russian Federation)); Denisov, A.G.; Golutvina, I.G. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of High Energy. 1991. 4p. (In Russian). Order Number DE93605868. Source: OSTI; NTIS (US Sales Only); INIS.

The characteristics of 200X10 mm scintillation polystyrene strips were studied. Two scintillators carried in composition, i.e. the first one considered of 1.5% PT+0,1% POPOP, the second considered of 1.5% PT+0,01% DBP. The ratio of the DBP scintillator luminosity to that of the POPOP scintillator is 0.8:1.0. 2 refs.; 2 figs.; 1 tab.

1418 (JINR-18-91-435) **Proton tomograph for the proton therapy facility.** Alekseev, G.I. (AN SSSR, Moscow (Russian Federation). Radiotekhnicheskij Inst.); Ivanov, I.A.; Klenov, G.I. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems. 1991. 12p. (In Russian). Order Number DE93605876. Source: OSTI; NTIS (US Sales Only); INIS.

The new scheme of proton computed tomography for the proton therapy facility at 250 MeV proton synchrotron is proposed. Model measurements of same tomographic systems were made at the LNP JINR phasotron. The narrow 250 MeV proton beam was formed and its widening by multiple Coulomb scattering in water was measured. A possibility of proton tomographic device creation at 250 MeV beam for clinical use was proved. 12 refs.; 7 figs.

1419 (JINR-E-10-91-161) **Parallel encoders for pixel detectors.** Nikityuk, N.M. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of High Energy. 1991. 12p. Order Number DE93605861. Source: OSTI; NTIS (US Sales Only); INIS.

A new method of fast encoding and determining the multiplicity and coordinates of fired pixels is described. A specific example construction of parallel encodes and MCC for n=49 and t=2 is given. 16 refs.; 6 figs.; 2 tabs.

1420 (JINR-E-10-91-361) **Track reconstruction in discrete detectors.** Chernov, N.I.; Kisel', I.V.; Korenchenko, S.M.; Ososkov, G.A. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Computing Techniques and Automation. 1991. 12p. Order Number DE93605862. Source: OSTI; NTIS (US Sales Only); INIS.

The probabilistic and geometrical analysis is given for data from experimental facilities like multiwire proportional chambers or strip detectors. The theoretical study showed that taking into account the discrete nature of data gives the accuracy of track reconstruction $\sqrt{N}$ better as compared with conventional least square fitting (here N is the number of measurements). For an idealized straight track model a simple, handy and fast algorithm is proposed for track reconstruction. It is modified to the case of circular tracks. 4 refs.; 9 figs.

1421 (JINR-R-1-91-42) **The device switching on spark gaps at the SLON setup.** Buriev, N.T. (Tadzhikskij Gosudarstvennyj Univ., Dushanbe (Tajikistan)); Kaplin, V.I.; Kovalenko, A.D. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of High Energy. 1991. 4p. (In Russian). Order Number DE93605863. Source: OSTI; NTIS (US Sales Only); INIS.

The device switching on triggered spark gaps at the setup SLON is described. The parameters of switching pulses are the following: pulse duration - 30 ms, maximum amplitude - 10 KV, switching current - 1 kA, increasing time - 2-3 ms. The main properties of the device are stability safety and it does not make hindrances to other systems. 2 refs.; 3 figs.

1422 (JINR-R-3-91-172) **Neutron Fourier diffractometer at the IBR-2 reactor.** Aksenov, V.L. (Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems); Balagurov, A.M.; Antson, O. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems. 1991. 14p. (In Russian). Order Number DE93605849. Source: OSTI; NTIS (US Sales Only); INIS.

The project of neutron high resolution Fourier diffractometer (HRFD) at the IBR-2 reactor is described. The expected parameters of HRFD are considered together with parameters of the best present day facilities. The general outline of the physical problems suitable for HRFD are also given. 15 refs.; 4 figs.; 2 tabs.

1423 (JINR-R-10-90-553) **A program-controlling distribution of high voltage in CAMAC standard.** Kadykov, M.G.; Shchelev, A.S.; Yarygin, G.A. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1990. 5p. (In Russian). Order Number DE93605864. Source: OSTI; NTIS (US Sales Only); INIS.

The description of a program-controlling 16-channels splitter of high voltage for spectrometers is presented. The designed device is mounted in two-width CAMAC module. The range of regulation is 500-3000 V with load current 1 mA and stability ± 1 V. 4 refs.; 1 fig.

1424 (JINR-R-10-91-147) **Number detector coding device for investigations on pulsed reactors by the time-of-flight method.** Novozhilov, V.E. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of High Energy. 1991. 6p. (In Russian). Order Number DE93605847. Source: OSTI; NTIS (US Sales Only); INIS.

The CAMAC device for number detector coding in time-of-flight experiments on pulsed reactors is described. The device connected with the time-to-digital converter allows one to register time-of-flight spectra for each detector with a maximum number of channels from 128 up to 4096 and the channel width from 0,5 μs and more. 7 refs.; 2 figs.

1425 (JINR-R-10-91-444) **Applications of discrete transformations in the problem of preliminary data processing for experiments in high energy physics.** Ososkov, G.A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation); Pospelov, A.S. Joint Inst. for Nuclear

Research, Dubna (Russian Federation). Lab. of Computing Techniques and Automation. 1991. 10p. (In Russian). Order Number DE93605865. Source: OSTI; NTIS (US Sales Only); INIS.

It is assumed that charged particle tracks detected in N coordinate planes are described by the linear model with S parameters. A method for the track-candidate selection is proposed. The corresponding algorithm requires (N-S) operations per every test and suites for hardware implementation. Results of numerical experiments are given, with show the satisfactory method reliability. 7 refs.; 1 tab.

1426 (JINR-R–10-91-463) **The device for coding the position in position sensitive detectors on the basis of the flash ADC.** Zen En Ken; Novozhilov, V.E.; Tishin, V.G. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems. 1991. 6p. (In Russian). Order Number DE93605848. Source: OSTI; NTIS (US Sales Only); INIS.

Two devices for coding the position in position sensitive detectors implemented on the basis of the monolithic flash ADC are described. The time of position coding is 0.5 μs. 6 refs.; 3 figs.

1427 (JINR-R–13-90-452) **Electronic equipment for selection of events in experiments on muon-catalyzed nuclear fusion reactions.** Gilev, A.I.; Ivanovskij, S.A.; Zinov, V.G.; Rudenko, A.I.; Selikov, A.V. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems. 1991. 8p. (In Russian). Order Number DE93605866. Source: OSTI; NTIS (US Sales Only); INIS.

A trigger part of the electronic equipment used in experiments on muon-catalyzed nuclear fusion reactions in a mixture of hydrogen isotopes is described. The main units of the trigger electronics are: a unit for separation of muon stops in the target and determination of the detection interval (a 10μs gate signal), it switches on the system of protection against double particles of the beam; a unit that determines the criterion of a useful event. The units are made to the standard of CAMAC modules of the double width. 12 refs.; 4 figs.

1428 (LA–12379-MS) **Directional fast-neutron detectors.** Garnett, A. (ed.); Byrd, R.C. Los Alamos National Lab., NM (United States). Oct 1992. 38p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE93000355. Source: OSTI; NTIS; INIS; GPO Dep.

Because neutrons are uncharged, neutron detectors must usually employ massive shielding in order to provide narrow angular resolution or to reduce the effect of backgrounds incident from different directions. If a detector is divided into multiple elements, the differences in count rate between different segments can indicate the direction of the incident neutron flux or provide corrections that cancel out the detector's response in certain directions. This report presents several calculations for this "active" collimation, which requires the use of much less shielding material than comparable passive approaches. Included are calculations for well-shielded detectors whose response is nonzero only over a narrow angular range, lightly shielded detectors whose response is zero over the entire rear hemisphere, and unshielded detectors that can accurately determine the direction of a suspected neutron source. These calculations are compared with available measurements and are in good-to-excellent agreement.

1429 (LA–12412-MS) **Liquid-scintillator stabilization with an internal ^{137}Cs source.** Miller, D.W. (Los Alamos National Lab., NM (United States)); Russo, P.A.; Ensslin, N.; Hurlbut, C. Los Alamos National Lab., NM (United States). Oct 1992. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE93000505. Source: OSTI; NTIS; GPO Dep.

A stabilization option has been examined for a prototype fast-neutron multiplicity counter that combines liquid scintillators and pulse-shape-discrimination circuitry. The fast-neutron counter has been found to exhibit long-term instability over the range of $\pm$10%. A new liquid scintillator with an internal ^{137}Cs source has been fabricated and tested to see if the source spectrum can be used for stabilization. This paper describes the design and testing of the new fast-neutron detector and scintillator.

1430 (LA-UR–92-3150) **Data acquisition system for the Large Scintillating Neutrino Detector at Los Alamos.** Anderson, G. (Linfield Coll., McMinnville, OR (United States)); Cohen, I.; Homann, B.; Smith, D.; Strossman, W.; VanDalen, G.J.; Weaver, L.S.; Evans, D.; Vernon, W.; Band, A.; Burman, R.; Chang, T.; Federspiel, F.; Foreman, W.; Gomulka, S.; Hart, G.; KozloLos Alamos National Lab., NM (United States). [1992]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-920966–2: 10. conference on computing in high energy physics, Annecy (France), 21-25 Sep 1992). Order Number DE93000700. Source: OSTI; NTIS; INIS; GPO Dep.

The data acquisition system for the Large Scintillating Neutrino Detector (LSND) is described. The system collects time and charge information in real time from 1600 photomultiplier tubes and passes the data in intelligent-trigger selected time windows to analysis computers, where events are reconstructed and analyzed as candidates for a variety of neutrino-related physics processes. The system is composed of fourteen VME crates linked to a Silicon Graphics, Inc. "4D/480" multiprocessor computer through multiple, parallel Ethernets, and a collection of contemporary high-performance workstations.

1431 (LBL–32347) **A neutron dose detector with REM response to 1 GeV.** Sun, R.K. (Lawrence Berkeley Lab., CA (United States)); Krebs, G.F.; Smith, A.R.; Hsu, H.H. Lawrence Berkeley Lab., CA (United States). Jul 1992. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-921102–20: Joint American Nuclear Society (ANS)/European Nuclear Society (ENS) international meeting on fifty years of controlled nuclear chain reaction: past, present, and future, Chicago, IL (United States), 15-20 Nov 1992). Order Number DE92041203. Source: OSTI; NTIS; GPO Dep.

The limitation of current remmeters, which do not measure neutron dose equivalents above about 15 MeV, is a serious problem at high-energy accelerator facilities, where a much wider range of neutron energies exist. The purpose of this work was to measure the response of a modified Anderson-Braun (A-B) remmeter to neutron energies up to 1 GeV. The modifications to the standard A-B remmeter were based on the experimental results of Pb(n,xn) reactions.

1432 (LBL–32526) **The UCLA Phi Factory detector, the integration of superconducting compensation solenoids and the final focus interaction region quadrupoles.** Green, M.A. (Lawrence Berkeley Lab., CA (United States)); Cline, D.B. Lawrence Berkeley Lab., CA (United States). Jun 1992. 4p. Sponsored by USDOE, Washington, DC (United States); National Aeronautics and Space Administration, Washington, DC (United States). DOE Contract AC03-76SF00098. (SC-MAG–388;CONF-920614–3: International cryogenic engineering conference and the international cryogenic materials conference, Kiev (Ukraine), 8-12 Jun 1992). Order Number DE92041179. Source: OSTI; NTIS; INIS; GPO Dep.

The proposed Phi Factory for the University of California at Los Angeles (UCLA) is a small 510 MeV electron-positron colliding beam storage ring with high luminosity (greater than 10^{32} CM^{-2} S^{-1}). In order to do high quality Phi physics, a particle detector system with a large solid angle (preferably greater than 98 percent) is required. Particle detection and analysis will be done within a 0.5 tesla solenoidal magnetic field. The solenoidal field within the detector causes coupling between beam oscillations in the horizontal and vertical directions. Therefore, compensation solenoids are required to keep the circulating particle beams from seeing the effects of the field from the main detector solenoid. Since high luminosity and a large solid angle are required, the detectors and a pair of compensation solenoids must be integrated with the final focus quadrupoles within the detector straight section. This report describes the design of two tapered, 0.5 tesla, superconducting compensation solenoids which must go around six rare earth permanent final focus quadrupoles or six superconducting quadrupoles on either side of the beam collision point. A cryogenic cooling system for these two solenoids, which will be coupled with the cooling system for the primary detector solenoid, is also described.

1433 (LBL-PUB–5347) **Conceptual design report for the Solenoidal Tracker at RHIC.** The STAR Collaboration. Lawrence

Berkeley Lab., CA (United States). 15 Jun 1992. 359p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. Order Number DE92041174. Source: OSTI; NTIS; INIS; GPO Dep.

The Solenoidal Tracker At RHIC (STAR) will search for signatures of quark-gluon plasma (QGP) formation and investigate the behavior of strongly interacting matter at high energy density. The emphasis win be the correlation of many observables on an event-by-event basis. In the absence of definitive signatures for the QGP, it is imperative that such correlations be used to identify special events and possible signatures. This requires a flexible detection system that can simultaneously measure many experimental observables. The physics goals dictate the design of star and it's experiment. To meet the design criteria, tracking, momentum analysis, and particle identification of most of the charged particles at midrapidity are necessary. The tracking must operate in conditions at higher than the expected maximum charged particle multiplicities for central Au + Au collisions. Particle identification of pions/kaons for $p < 0.7$ GeV/c and kaons/protons for $p < 1$ GeV/c, as well as measurement of decay particles and reconstruction of secondary vertices will be possible. A two-track resolution of 2 cm at 2 m radial distance from, the interaction is expected. Momentum resolution of $\Delta p/p \sim 0.02$ at $p = 0.1$ GeV/c is required to accomplish the physics, and,$\Delta p/p$ of several percent at $p = 10$ GeV/c is sufficient to accurately measure the rapidly failing spectra at high Pt and particles from mini-jets and jets.

1434 (NIKHEF-K-EMIN–92-01) **Efficiency calculations of the hadron detector.** Spreckelsen, Paul von. Nationaal Inst. voor Kernfysica en Hoge-Energiefysica (NIKHEF), Amsterdam (Netherlands). Sectie K. Nov 1991. 21p. Order Number DE93603917. Source: OSTI; NTIS; INIS.

At NIKHEF-K 2 plastic scintillator detectors (hadron detectors), box1 and box2, were developed for (e,e'pp) reactions. They were in operation during the summers of 1989 and 1990. These hadron detectors combine a large solid angle (approximately 40 msr) with large momentum acceptance. They were designed to detect protons emitted in energy range 25-158MeV and 37-198MeV, respectively. Both detectors are highly segmented in order to cope with the high singles count rate, which is expected. Since these hadron detectors are of a new type, little is known about their performance. This report describes the methods followed to find out (where possible) the efficiency of each element of one of the detectors. Moreover, for some elements the energy dependency of the efficiency was also examined. The presented calculations were done with data from box1, positioned at a scattering angle, θ, of 120deg. (author). 2 refs.; 5 figs.; 6 tabs.

1435 (RAL–92-031) **The high resolution powder diffractometer (HRPD) at ISIS - a user guide.** Ibberson, R.M.; David, W.I.F.; Knight, K.S. Rutherford Appleton Lab., Chilton (United Kingdom). May 1992. 38p. Order Number DE93603984. Source: OSTI; NTIS (US Sales Only); INIS.

Version 2.1.

This guide is intended to give a short description of the High Resolution Powder Diffractometer, HRPD, at ISIS and to provide the basic information required in order to perform a routine powder diffraction experiment. (Author).

1436 (RAL–92-032) **Profile analysis of neutron powder diffraction data at ISIS.** David, W.I.F.; Ibberson, R.M.; Matthewman, J.C. Rutherford Appleton Lab., Chilton (United Kingdom). May 1992. 40p. Order Number DE93603985. Source: OSTI; NTIS (US Sales Only); INIS.

The aim of this manual is to document the current suite of time-of-flight neutron powder diffraction profile refinement programs available to ISIS users. Aspects of data collation and normalisation specific to the individual diffraction instruments are dealt with elsewhere. It will be assumed the user has produced a suitable data file (.DAT file) containing the profile data consisting of point by point values of the corrected diffraction profile across the pattern. The analysis of neutron powder diffraction data at ISIS by profile refinement utilises a suite of "in-house" written and supported programs based on the Cambridge Crystallography Subroutine Library (CCSL). A quick scan through the CCSL manual will give the user a general feel for the procedure to adopt in the use of the library and hence of the profile codes. The instructions documented in this handbook are complementary to those in the more specialist CCSL manual, and consequently go into no great detail regarding technical details of any of the CCSL routines. The programs may be run from each individual user account, for example [USER01], once the appropriate login procedure has been set-up by the instrument scientists. The programs are mostly activated by one line commands and only a basic knowledge of a VAX editor should be required; details can be found in the "VAX primer" available from Computer Support. (Author).

1437 (SINS–2106/A, pp. 80-83) **The cluster counter as a part of the 4-facility at SIS/ESR.** Tezkratt, R. (Strasbourg-1 Univ., 67 (France). Centre de Recherches Nucleaires); Cerruti, C.; Coffin, J.P.; Fintz, P.; Guillaume, G.; Jundt, F.; Maguire, C.F.; Rami, F.; Wagner, P. Institute of Atomic Energy, Otwock-Swierk (Poland). Nov 1990. (CONF-900857–: 21. Mikolajki summer school on nuclear physics: nuclear and atomic physics with accelerators of the nineties, Mikolajki (Poland), 26 Aug - 5 sep 1990). In *Nuclear and atomic physics with the accelerators of the nineties: Proceedings of the 21st Mikolajki summer school on nuclear physics, held in Mikolajki, Poland, August 26 - September 5, 1990. Seminars.* 111p. Order Number DE93604421. Source: OSTI; NTIS (US Sales Only); INIS.

A cluster detector composed of ionization chambers and thin plastic scintillators has been developed as part of the large 4π-detector at SIS/ESR. (author).

1438 (SINS–2106/A, pp. 84-88) **TAPS - a two arm photon spectrometer for the detection of neutral mesons and single photons.** Pfeiffer, M. (Giessen Univ. (Germany). 2. Physikalisches Inst.). TAPS-Collaboration. Institute of Atomic Energy, Otwock-Swierk (Poland). Nov 1990. (CONF-900857–: 21. Mikolajki summer school on nuclear physics: nuclear and atomic physics with accelerators of the nineties, Mikolajki (Poland), 26 Aug - 5 sep 1990). In *Nuclear and atomic physics with the accelerators of the nineties: Proceedings of the 21st Mikolajki summer school on nuclear physics, held in Mikolajki, Poland, August 26 - September 5, 1990. Seminars.* 111p. Order Number DE93604421. Source: OSTI; NTIS (US Sales Only); INIS.

A photon-spectrometer for the detection of neutral mesons and single photons has been built. It will be used at several facilities to study heavy ion (GSI and GANIL) and photon induced (MAMI B) reactions. The spectrometer consists at present of 4 blocks with 64 BaF_2-scintillation detectors each. The blocks are arranged in two movable towers to provide a flexible geometry. The spectrometer has been recently used for a first experiment (350 MeV/u ^{20}Ne on ^{27}Al) at GSI. Preliminary results from this run will be presented. (author).

1439 (SINS–2106/A, pp. 89-102) **In-beam electron spectroscopy with collinear geometry.** Dionisio, J.S. (Paris-11 Univ., 91 - Orsay (France). Centre de Spectrometrie Nucleaire et de Spectrometrie de Masse); Meliani, Z.; Schuech, C.; Vieu, Ch. Institute of Atomic Energy, Otwock-Swierk (Poland). Nov 1990. (CONF-900857–: 21. Mikolajki summer school on nuclear physics: nuclear and atomic physics with accelerators of the nineties, Mikolajki (Poland), 26 Aug - 5 sep 1990). In *Nuclear and atomic physics with the accelerators of the nineties: Proceedings of the 21st Mikolajki summer school on nuclear physics, held in Mikolajki, Poland, August 26 - September 5, 1990. Seminars.* 111p. Order Number DE93604421. Source: OSTI; NTIS (US Sales Only); INIS.

The basic relations for the Doppler shift and Doppler broadening of an electron line given by an electron spectrometer oriented in the collinear geometry are discussed in detail. The main features of the in-beam e-γ spectrometer recently operated with direct collinear geometry (i.e. with $20 \geq \alpha \geq 10$ deg) at Orsay's MP Tandem accelerator are briefly described. The interesting performances of that instrument for the investigation of prompt and short delayed low energy transitions ($E_\gamma \leq 200$ keV) deexciting nuclear high spin states are illustrated with a few typical examples. Further developments with reverse collinear geometry (i.e. with 170 deg $\geq \alpha \geq$ 160 deg) are also shortly discussed in the present context of nuclear structure studies involving in-beam nuclear spectroscopic measurements. (author).

1440 (SLAC-PUB–5927) **FAD: A full-acceptance detector for physics at the SSC.** Bjorken, J.D. Stanford Linear Accelerator Center, Menlo Park, CA (United States). Sep 1992. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00515. (CONF-9206284–1: 7. international symposium on very high energy cosmic ray interactions, Ann Arbor, MI (United States), 21-27 Jun 1992). Order Number DE93001765. Source: OSTI; NTIS; INIS; GPO Dep.

For high energy pp collisions, the concepts "4π" and "full acceptance" are distinct. At the SSC, the appropriate variables for describing phase space are the lego variables: pseudorapidity η and azimuthal angle ϕ. While most of 4π is covered by pseudorapidities less than 3 or 4 in magnitude, at the SSC there is very interesting physics out to η's of 9 to 12. For over a year I have been attempting to encourage an initiative at the SSC to provide a detector which could cover the missing acceptance of the two big detectors, which in particular have no appreciable charged particle tracking with good momentum resolution beyond rapidities of 2.5 or so. The nonnegotiable criteria for an FAD are for me the following: 1. All charged particles are seen and their momenta measured well, provided pt is not too large. 2. All photons are seen and their momenta are measured well. 3. The physics of rapidity-gaps is not compromised. This means angular coverage from 90° down to tens of microradians. The above criteria cannot be met on day one of SSC commissioning with the amount of funds available. But I believe a staged approach is feasible, with a lot of interesting physics available along the way. The basic philosophy underlying the FAD idea is that it should first and most be a survey instrument, sensitive to almost everything, but optimized for almost nothing. Its strength is in the perception of complex patterns individual events, used as a signature of new and/or interesting physics. Examples of such patterns will be given later.

1441 (UCRL-JC–109349) **Microchannel plate intensifier gain uniformity improvement in sealed tubes by selective scrubbing.** Thomas, S. (Lawrence Livermore National Lab., CA (United States)); Behnke, A. Lawrence Livermore National Lab., CA (United States). Aug 1992. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9209188–4: 20. international congress on high speed photography and photonics, Victoria (Canada), 25-26 Sep 1992). Order Number DE92041082. Source: OSTI; NTIS; GPO Dep.

We have improved the gain uniformity of sealed microchannel plate image intensifiers (MCPIs) by selectively scrubbing the high gain sections with a controlled bright light source. The major contributor to poor uniformity on most of the tubes we have tested is the cathode, with the MCP and screen making only minor contributions. Using the premise that ions returning to the cathode from the MCP damage the cathode and reduce its sensitivity, we raster scanned an HeNe laser beam light source across the cathode of an MCPI tube. Cathode current was monitored and when it exceeded a present threshold, the sweep rate was decreased 1000 times, giving 1000 times the exposure to cathode areas with sensitivity greater than the threshold. The threshold was set at the cathode current corresponding to the lowest sensitivity in the active cathode area so that sensitivity of the entire cathode would be reduced to this level. This process reduced tube gain by between 10% and 30% in the high gain areas while gain reduction in low gain areas was negligible. Effects on cathode spectral sensitivity and phosphor efficiency, the results of including the MCP in the feedback loop, the possibility of reclaiming tubes damaged by prolonged exposure to resolution targets, and circuit details are discussed.

1442 (UCRL-JC–111225) **High sensitivity external modulator data link for high energy particle detector diagnostics.** McCammon, K. (Lawrence Livermore National Lab., CA (United States)); Lowry, M.; Wuest, C.; McConaghy, C.; Yuanhann Chang; Wyslouch, B.; Becker, U.; Parker, P. Lawrence Livermore National Lab., CA (United States). May 1992. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9205210–3: 2. annual conference on electronics for future colliders, Chestnut Ridge, NY (United States), 19-21 May 1992). Order Number DE92041084. Source: OSTI; NTIS; GPO Dep.

An analog fiber-optic data link has been demonstrated for direct charge readout of wire chambers used in high energy particle detectors. The fiber link consists of a Nd:YAG laser carrier, a Mach-Zehnder external modulator, and a low-noise optical receiver. A charge pulse developed on a sensing wire flows directly into the electro-optic modulator with no preamplification. The substitution of passive modulators and fiber cable for active electronics and copper wire near large collider detectors has clear advantages with regard to radiation damage susceptibility, EMI immunity, physical size, and power consumption. Also, the modulator performance was unaffected for an applied one Tesla magnetic field. Reduction of noise contributions from the laser carrier and optical receiver and exploitation of the "effective optical gain" properties of external modulators resulted in shot-noise-limited link sensitivity. Modulators were, packaged with large termination resistors enabling increased charge sensitivity with an increased system risetime tradeoff. Energy resolution of the fiber HA was comparable to preamps condidonal on large terminations and subsequent slow readout For shorter risetimes required in timing diagnostics, small terminations resulted in sensitivity 6.8 times inferior to preamps. Several potential improvements in sensitivity are discussed.

4402 Radiation Effects On Instrument Components, Instruments, Or Electronic Systems

Refer also to citation(s) 1078, 1084, 1280, 1281, 1377, 1441, 1442

1443 (CEA-CONF–10967) **Experimental study of charge collection in PN, NP diodes and MOS capacitor struck by heavy ions.** Patin, Y.; Lochard, J.P.; Gosselin, G. CEA Centre d'Etudes de Bruyeres-le-Chatel, 91 (France). 1991. 4p. (In French). (CONF-9109232–: RADECS 91: radiation effects on components and systems, Montpellier (France), 9-12 Sep 1991). Order Number DE93721210. Source: OSTI; NTIS (US Sales Only); INIS.

Charge collection in PN and silicon diodes and MOS capacitor struck by heavy ions, has been experimentally studied. We have analysed a large set of data obtained at GANIL, Saclay and Bruyeres-le-Chatel accelerators. General laws have been deduced to describe the FUNNELING phenomena as function of circuit polarisation and ion penetration.

1444 (CEA-CONF–11022) **Charge collection mechanisms in MOS/SOI transistors irradiated by energetic heavy ions.** Musseau, O. (CEA Centre d'Etudes de Bruyeres-le-Chatel, 91 (France)); Leray, J.L.; Ferlet, V.; Umbert, A.; Coic, Y.M.; Hesto, P. CEA Centre d'Etudes de Bruyeres-le-Chatel, 91 (France). 1991. 8p. (CONF-910751–: Institute of Electrical and Electronic Engineers (IEEE) annual international nuclear and space radiation effects conference, San Diego, CA (United States), 15-19 Jul 1991). Order Number DE93721142. Source: OSTI; NTIS (US Sales Only); INIS.

We have investigated with both experimental and numerical methods (Monte Carlo and drift-diffusion models) various charge collection mechanisms in NMOS/SOI transistors irradiated by single energetic heavy ions. Our physical interpretations of data emphasize the influence of various parasitic structures of the device. Two charge collection mechanisms are detailed: substrate funneling in buried MOS capacitor and latching of the parasitic bipolar transistor. Based on carrier transport and charge collection, the sensitivity of future scaled down CMOS/SOI technologies is finally discussed.

1445 (CEA-CONF–11023) **Semi-empirical modelization of charge funneling in a NP diode.** Musseau, O. CEA Centre d'Etudes de Bruyeres-le-Chatel, 91 (France). 1991. 5p. (In French). (CONF-9109232–: RADECS 91: radiation effects on components and systems, Montpellier (France), 9-12 Sep 1991). Order Number DE93721143. Source: OSTI; NTIS (US Sales Only); INIS.

Heavy ion interaction with a semiconductor generates a high density of electrons and holes pairs along the trajectory and in a space charge zone the collected charge is considerably increased. The chronology of this charge funneling is described in a semi-empirical model. From initial conditions characterizing the incident ion and the studied structure, it is possible to evaluate directly the transient current, the collected charge and the length of funneling with a good agreement. The model can be extrapolated to more complex structures.

1446 (CEA-CONF–11024) **Monte Carlo modelling of the effect of an heavy ion on the operation of a MISFET/SOI.** Musseau, O. (CEA Centre d'Etudes de Bruyeres-le-Chatel, 91 (France)); Hesto, P.; Dollfus, P.; Mouis, M. CEA Centre d'Etudes de Bruyeres-le-Chatel, 91 (France). 1991. 5p. (In French). (CONF-9109232–: RADECS 91: radiation effects on components and systems, Montpellier (France), 9-12 Sep 1991). Order Number DE93721144. Source: OSTI; NTIS (US Sales Only); INIS.

Electron-hole pairs are created along the track of an heavy ion, return to the original state of these charge carriers are studied by a Monte Carlo model. The structure studied are MISFET transistors, insulated from the substrate by a buried dielectric. The grid insulating material is silicon nitride and the buried dielectric is Yttria stabilized zirconia. They were chosen because they are more radiation resistant than silicon oxide.

1447 (CEA-CONF–11025) **Effects of X or gamma radiation dose on vitreous silicon oxides and Silicon On Insulator buried oxides by the study of trapped charges and paramagnetic defects.** Leray, J.L. (CEA Centre d'Etudes de Bruyeres-le-Chatel, 91 (France)); Coic, Y.M.; Margail, J.; Devine, R.A.B. CEA Centre d'Etudes de Bruyeres-le-Chatel, 91 (France). 1991. 10p. (In French). (CONF-9109232–: RADECS 91: radiation effects on components and systems, Montpellier (France), 9-12 Sep 1991). Order Number DE93721145. Source: OSTI; NTIS (US Sales Only); INIS.

Silicon On Insulator (SOI-SIMOX) buried oxides and Suprasil silica glasses have been irradiated so as to compare charge trapping and paramagnetic defect center generation phenomena. Parameters used in the study were: X or γ-ray irradiation, and electric field bias applied during irradiation. Positive or negative charge trapping is depending upon the sign of the bias field in the SIMOX (Separation by Implantation of Oxygen) buried MOS structure, and is correlated with E' paramagnetic center generation. In the two cases, the charge trapping mechanism or E' center generation are very sensitive to the electric field magnitude. In the SIMOX oxide, synthesized by oxygen implant, the EPR spectrum is confirmed to exhibit a characteristic 2-peak structure.

1448 (CEA-CONF–11026) **Radiation dose effects, hardening of electronic components.** Dupont-Nivet, E. CEA Centre d'Etudes de Bruyeres-le-Chatel, 91 (France). 1991. 34p. (In French). (CONF-9109232–: RADECS 91: radiation effects on components and systems, Montpellier (France), 9-12 Sep 1991). Order Number DE93721146. Source: OSTI; NTIS (US Sales Only); INIS.

This course reviews the mechanism of interaction between ionizing radiation and a silicon oxide type dielectric, in particular the effect of electron-hole pairs creation in the material. Then effects of cumulated dose on electronic components and especially in MOS technology are examined. Finally methods hardening of these components are exposed. 93 refs.

1449 (JINR-R–7-91-29) **The mathematical modelling of radiation damages of HTSC bolometers.** Barashenkov, V.S.; Polyanski, A.; Sosnin, A.N.; Shmakov, S.Yu. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Computing Techniques and Automation. 1991. 2p. (In Russian). Order Number DE93605911. Source: OSTI; NTIS (US Sales Only); INIS.

Variation in performance of HTSC bolometer depending on the type of bombarding particle is investigated by means of Monte Carlo method. It is shown that the heat induced on the HTSC element in respect to one nucleon of a bombarding particle for energies of some GeV/nucleon remains practically invariable. The performance of the bolometer is charged significantly for fluxes of the order of 10^9 protons/cm^{2}xc and up. 1 ref.; 1 tab.

1450 (JINR-R–12-91-433) **Effects of atomic hydrogen on polymeric track detectors.** Apel', P.Yu. (and others); Kuznetsov, V.I.; Luppov, V.G. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems. 1991. 12p. (In Russian). Order Number DE93605910. Source: OSTI; NTIS (US Sales Only); INIS.

The effects of atomic hydrogen on polymeric track detectors were investigated. The detectors in the form of films 8-10 μ thick were beforehand irradiated by xenon ions with an energy of ca. The modelling of the track formation process in terms of this concept can be more successful than the attempts made before based on the calculations of the spatial distribution of the energy deposited by delta electrons. 8 refs.; 3 figs.

1451 (LBL–32500) **Chemistry of radiation damage to wire chambers.** Wise, J. Lawrence Berkeley Lab., CA (United States). Aug 1992. 127p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. Order Number DE93000627. Source: OSTI; NTIS; INIS; GPO Dep.

Proportional counters are used to study aspects of radiation damage to wire chambers (wire aging). Principles of low-pressure, rf plasma chemistry are used to predict the plasma chemistry in electron avalanches (1 atm, dc). (1) Aging is studied in CF_4/iC_4H_{10} gas mixtures. Wire deposits are analyzed by Auger electron spectroscopy. An apparent cathode aging process resulting in loss of gain rather than in a self-sustained current is observed in CF_4-rich gases. A four-part model considering plasma polymerization of the hydrocarbon, etching of wire deposits by CF_4, acceleration of deposition processes in strongly etching environments, and reactivity of the wire surface is developed to understand anode wire aging in CF_4/iC_4H_{10} gases. Practical guidelines suggested by the model are discussed. (2) Data are presented to suggest that trace amounts of Freons do not affect aging rates in either dimethyl ether or Ar/C_2H_6. Apparent loss of gain is explained by attachment of primary electrons to a continuously increasing concentration of Freon 11 (CCl_3F) in the counter gas. An increase in the concentration of Freon 11 in dimethyl ether is caused by a distillation process in the gas supply bottle and is a natural consequence of the unequal volatilities of the two compounds.

1452 (SAND–92-2043C) **Radiation hardened nonvolatile memory for space and strategic applications.** Jacunski, M. (Westinghouse Electric Corp., Linthicum, MD (United States). Advanced Technology Div.); Williams, D.; Adams, D.; Bishop, R.; Murray, J.; Jakubczak, J.; Rodriguez, J. Sandia National Labs., Albuquerque, NM (United States). [1992]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-921188–1: Government microcircuit applications conference: microelectronics in the new world order, Las Vegas, NV (United States), 9-12 Nov 1992). Order Number DE93000746. Source: OSTI; NTIS (US Sales Only); GPO Dep.

As system complexity increases, so too do the nonvolatile memory needs for the storage of data and microconic. Electrically erasable programmatic read only memories (EEPROMs) are also the frequent choice for applications which in the past have been satisfied by read only memories (ROMs). For system engineers. the ability to electrically reprogram a system module on the fly is indispensable. Two different modes of operation must be considered when evaluating the radiation hardness of EEPROMS. For ROM applications, little if any programming occurs in the radiation environment, and only the read mode need be considered. Here, the chip must (1) retain the information throughout the irradiation, and (2) maintain the functionality of the peripheral circuits necessary for reading the data. For nonvolatile SRAM type applications, the chip must also function in the write mode during the exposure. Unfortunately, commercial EEPROMs have not kept pace with the aggressive radiation specifications of many space and strategic systems. Several studies indicate that the most popular commercial floating gate (FG) technologies manufactured by Xicor, Atmel, and Seeq fail after total doses of just 4 to 18 Krad(Si) in the read mode and after less than 5 Krad(Si) in the write mode. In fact, the very nature of the commercial FG technology has been shown to be limited to a hardness of less than 100 Krad(Si). This paper describes a 64K EEPROM designed by Sandia National Laboratories (SNL) and manufactured by Westinghouse Electric Corporation (WEC). It is pin for pin compatible with commercial 64K EEPROMS. The nonvolatile memory clement is fabricated with a silicon /oxide / nitride /oxide /semiconductor (SONOS) technology for which 1 Mrad(Si) hardness has been demonstrated. In addition, the CMOS peripheral circuitry has been hardened using techniques developed for Westinghouse's radiation hardened gate array products.

4404 Well Logging Instrumentation

1453 (STRIPA-TR–92-16) **Directional borehole antenna - Theory.** Falk, L. (ABEM, Uppsala (Sweden)). Swedish Nuclear

Fuel and Waste Management Co., Stockholm (Sweden). Feb 1992. 156p. Order Number DE93603986. Source: OSTI; NTIS; INIS.

A directional antenna has been developed for the borehole radar constructed during phase 2 of the Stripa project. The new antenna can determine the azimuth of a strong reflector with an accuracy of about 3 degrees as confirmed during experiments in Stripa, although the ratio of borehole diameter to wavelength is small, about 0.03. The antenna synthesizes the effect of a loop antenna rotating in the borehole from four signals measured in turn by a stationary antenna. These signals are also used to calculate an electric dipole signal and a check sum which is used to examine the function of the system. The theory of directional antennas is reviewed and used to design an antenna consisting of four parallel wires. The radiation pattern of this antenna is calculated using transmission line theory with due regard to polarization, which is of fundamental importance for the analysis of directional data. In particular the multipole expansion of the field is calculated to describe the antenna radiation pattern. Various sources of error, e.g. the effect of the borehole, are discussed and the methods of calibrating the antenna are reviewed. The ambiguity inherent in a loop antenna can be removed by taking the phase of the signal into account. Typical reflectors in rock, e.g. fracture zones an tunnels, may be modelled as simple geometrical structures. The corresponding analysis is described and exemplified on measurements from Stripa. Radar data is nowadays usually analyzed directly on the computer screen using the program RADINTER developed within the Stripa project. An algorithm for automatic estimation of the parameters of a reflector have been tested with some success. The relation between measured radar data and external coordinates as determined by rotational indicators is finally expressed in terms of Euler angles. (au).

4405 Thermal Instrumentation

Refer also to citation(s) 845

1454 (UCRL-JC–111214) **Dual-band infrared imaging applications: Locating buried minefields, mapping sea ice, and inspecting aging aircraft.** Del Grande, N.K.; Durbin, P.F.; Perkins, D.E. Lawrence Livermore National Lab., CA (United States). Sep 1992. 8p. Sponsored by Department of Defense, Washington, DC (United States); Merentutkimuslaitos, Helsinki (Finland). DOE Contract W-7405-ENG-48. (CONF-9207155–1: Quantitative nondestructive evaluation conference, San Diego, CA (United States), 19-24 Jul 1992). Order Number DE93000516. Source: OSTI; NTIS; GPO Dep.

We discuss the use of dual-band infrared (DBIR) imaging for three quantitative NDE applications: location buried surrogate mines, mapping sea ice thicknesses and inspecting subsurface flaws in aging aircraft parts. Our system of DBIR imaging offers a unique combination of thermal resolution, detectability, and interpretability. Pioneered at Lawrence Livermore Laboratory, it resolves 0.2 °C differences in surface temperatures needed to identify buried mine sites and distinguish them from surface features. It produces both surface temperature and emissivity-ratio images of sea ice, needed to accurately map ice thicknesses (e.g., by first removing clutter due to snow and surface roughness effects). The DBIR imaging technique depicts subsurface flaws in composite patches and lap joints of aircraft, thus providing a needed tool for aging aircraft inspections.

4406 Optical Instrumentation

Refer also to citation(s) 950, 1485

1455 (DOE/ER/40673–1) **[SSC and G-2 calorimeter optical calibration].** Fairfield Univ., CT (United States). Dept. of Physics. [1992]. 37p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-91ER40673. Order Number DE92019732. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents information concerning the two main project tasks: (1) SSC R&D and (2) Detectors for the G-2 experiment (E821 at BNL).(JDB)

1456 (LA-UR–92-3171) **Evaluation of environmentally safe cleaning agents for diamond turned optics.** Theye, L.A.; Day, R.D.; Scott, M. Los Alamos National Lab., NM (United States). Oct 1992. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-9210167–1: Aerospace hazardous material management, St. Louis, MO (United States), 27-29 Oct 1992). Order Number DE93000873. Source: OSTI; NTIS; INIS; GPO Dep.

Ellipsometry has been shown to be an effective method for determining surface cleanliness. It is a quick (a single point measurement can be made in about 10 minutes), relatively easy, and precise method to use in these studies. It does require that the index of refraction be measured independently and that a model based-upon these measurements be developed. This model can be developed in a straightforward manner using a commercial software routine. The data indicate that several of the solvents can be used in place of TCA for cleaning diamond machined copper without sacrificing cleaning ability. Costs must be considered when choosing a solvent, however.

1457 (SAND–91-2871C) **Pulsed holography for hypervelocity impact diagnostics.** Ang, J.A. (Sandia National Labs., Albuquerque, NM (United States)); Hansche, B.D.; Konrad, C.H.; Sweatt, W.C.; Gosling, S.M.; Hickman, R.J. Sandia National Labs., Albuquerque, NM (United States). [1992]. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-921162–6: Hypervelocity impact symposium, Austin, TX (United States), 17-20 Nov 1992). Order Number DE92040259. Source: OSTI; NTIS; GPO Dep.

Pulsed holography is being developed to meet two principal objectives. The first objective is to quantify the three dimensional characteristics of hypervelocity impact events, and the second is to provide a diagnostic with the ability to capture high fidelity information for the validation of sophisticated three-dimensional hydrocodes. The holographic system uses a Q-switched, seeded, frequency-doubled Nd-YAG laser which produces 5 ns, 750 mJ, coherent pulses at 532 nm. Holographic images have been captured of the back-surface debris bubble from 4 km/s perforating impacts and crater ejecta from 2 km/s non-perforating impacts. A prototype holographic reconstruction and image analysis system has been assembled that provides the ability to measure the structure and individual particles produced in a hypervelocity impact event. The estimated image resolution of this system is 10 to 20 μm; however, this level of performance has not yet been demonstrated.

1458 (SAND–92-0651C) **Dielectric optical waveguide sensors integrated with GaAs active devices.** Carson, R.F.; Casalnuovo, S.A.; Sinclair, M.B. Sandia National Labs., Albuquerque, NM (United States). [1992]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-9209184–3: The International Society for Optical Engineering (SPIE) meeting, Boston, MA (United States), 8-11 Sep 1992). Order Number DE93000750. Source: OSTI; NTIS; GPO Dep.

Dielectric optical waveguides exhibit properties that are well suited to sensor applications. They have low refractive index and are transparent to a wide range of wavelengths. They can react with the surrounding environment in a variety of controllable ways. In certain sensor applications, its is advantageous to integrate the dielectric waveguide on a semiconductor substrate with active devices. In this work, we demonstrate a tamper sensor based on dielectric waveguides that connect epitaxial GaAs-GaAlAs sources and detectors. The tamper sensing function is by attaching particles of absorbing material with high refractive index to the surface of the waveguides. These absorbers are then attached to a lid or cover, as in an integrated circuit package or multi-chip module. The absorbers attenuate the light in the waveguides as a function of absorber interaction. The absorbers are placed randomly on the waveguides, to form a unique attenuation pattern that is registered by the relative signal levels on the photodetectors. When the lid is moved, the pattern of absorbers changes, altering the photodetector signals. The dielectric waveguide arrangement is applicable to a variety of sensor functions, and can make use of resonant coupling properties between low refractive index dielectric waveguides and high-index absorbing materials.

1459 (UCRL-JC–109606-R1) **Sodium guide star adaptive optics system for astronomical imaging in the visible and near-infrared: Revision 1.** Gavel, D.T. (Lawrence Livermore National Lab., CA (United States)); Morris, J.R.; Vernon, R.G. Lawrence Livermore National Lab., CA (United States). Aug 1992. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-920853–4: Nonlinear optics: materials, fundamentals, and applications, Maui, HI (United States), 17-21 Aug 1992). Order Number DE92041081. Source: OSTI; NTIS; GPO Dep.

We are building an adaptive-optic telescope system that is based on the use of an artificial guide star created by laser-induced fluorescence of the sodium mesospheric layer. This paper discusses the system design for mid-visible to near-infrared compensation of a one meter telescope at Livermore and near-infrared compensation of the ten meter Keck telescope at Mauna Kea. We calculate the expected Strehl ratio and resolution for a 69 channel deformable mirror system and also for a possible 24 channel system upgrade. With the 69 actuator system we expect near diffraction limited resolution, about 0.2 arcsec, with a Strehl ratio of about 0.5 at γ=0.8 μm on the 1m telescope, and resolution of about 0.05 arcsec with a Strehl ratio of about 0.5 at γ=2.0 μm on the 10m telescope. Resolution will be limited by the performance of the tip/tilt correction loop, which uses an off-axis natural guide star as a reference. At Livermore, our design uses an existing high power (1 kW) laser source, which is expected to provide an approximately 6th magnitude artificial guide star. This strong beacon signal allows a short integration time in the wavefront sensor so that temporal changes in the atmospheric turbulence can be tracked accurately. For Mauna Kea, we explore how the system to be built for the Livermore site would perform in the infrared, assuming a 100 W laser source.

4407 Geophysical and Meteorological Instrumentation

Refer also to citation(s) 417

4408 Miscellaneous Instrumentation

Refer also to citation(s) 553, 950, 1276, 1356, 1474, 1642

45 MILITARY TECHNOLOGY, WEAPONRY, AND NATIONAL DEFENSE

Refer also to citation(s) 2476

1460 (ANL/EAIS/TM–70-Vol.1) **Summary of requirements collected and prototype systems developed by Argonne National Laboratory in support of the SOFPARS Program: Volume 1, Overview of SOFPARS requirements.** Peerenboom, J.P.; Baines, T.B.; Braun, M.D.; Cortese, D.L.; Crowe, C.M.; Fuja, R.S.; Greene, R.J.; Gregor, R.A.; Kavicky, J.A.; Love, R.J.; Macal, C.M.; Nevins, M.R.; Paddock, R.A.; Ramsey, G.M.; Roberson, C.F.; Robinson, G.L.; St. Aubin, J.A.; Sapinski, PArgonne National Lab., IL (United States). Environmental Assessment and Information Sciences Div. May 1992. 91p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE93000396. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report summarizes information collected by Argonne National Laboratory (ANL) in support of the Special Operations Forces Planning and Rehearsal System (SOFPARS) Program. The focus is on the ground and maritime elements within the US Special Operations Command (USSOCOM), with particular emphasis on the joint aspects of special operations (SO) mission planning. The specific objective of this report is to document the following: Requirements for SOFPARS specified by SO personnel; Concept-of-operations information specified as part of the requirements-definition process, and Prototypes developed by ANL to assist SO personnel in defining and refining the requirements for SOFPARS. Requirements derived from or implied by the specified requirements are also discussed. In addition, background information is provided to aid in understanding the basis for requirements that call for the use of artificial intelligence and related technologies.

1461 (ORNL/TM–11973) **Graphics development of DCOR: Deterministic combat model of Oak Ridge.** Hunt, G. (Georgia Inst. of Tech., Atlanta, GA (United States)); Azmy, Y.Y. Oak Ridge National Lab., TN (United States). Oct 1992. 45p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93001882. Source: OSTI; NTIS; GPO Dep.

DCOR is a user-friendly computer implementation of a deterministic combat model developed at ORNL. To make the interpretation of the results more intuitive, a conversion of the numerical solution to a graphic animation sequence of battle evolution is desirable. DCOR uses a coarse computational spatial mesh superimposed on the battlefield. This research is aimed at developing robust methods for computing the position of the combative units over the continuum (and also pixeled) battlefield, from DCOR's discrete-variable solution representing the density of each force type evaluated at gridpoints. Three main problems have been identified and solutions have been devised and implemented in a new visualization module of DCOR. First, there is the problem of distributing the total number of objects, each representing a combative unit of each force type, among the gridpoints at each time level of the animation. This problem is solved by distributing, for each force type, the total number of combative units, one by one, to the gridpoint with the largest calculated number of units. Second, there is the problem of distributing the number of units assigned to each computational gridpoint over the battlefield area attributed to that point. This problem is solved by distributing the units within that area by taking into account the influence of surrounding gridpoints using linear interpolation. Finally, time interpolated solutions must be generated to produce a sufficient number of frames to create a smooth animation sequence. Currently, enough frames may be generated either by direct computation via the PDE solver or by using linear programming techniques to linearly interpolate intermediate frames between calculated frames.

4501 Chemical Explosions and Explosives

Refer also to citation(s) 316, 1466

1462 (LA–12235-MS) **DSD technology: a detonation reactive Huygens code.** Bdzil, J.; Fickett, W. Los Alamos National Lab., NM (United States). Jul 1992. 49p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE93002714. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The length of the reaction zone strongly influences the speed of propagation of detonation in multidimensional explosive pieces. Detonation Shock Dynamics (DSD) properly accounts for these effects in detonation wave-spreading problems when the radius of curvature of the multi-dimensional detonation shock is large compared to the explosive's reaction-zone length. This report is a user manual for our two-dimensional implementation of this method; a FORTRAN subroutine called DSD Technology.

1463 (SAND–91-2722C) **The development of an on-site container.** Glass, R.E. (Sandia National Labs., Albuquerque, NM (United States)); McAllaster, M.E.; Jones, P.L.; McKinney, A.L. Sandia National Labs., Albuquerque, NM (United States). [1991]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-920905–17: 10. international symposium on the packaging and transportation of radioactive materials: PATRAM '92, Yokohama (Japan), 13-18 Sep 1992). Order Number DE92040097. Source: OSTI; NTIS; GPO Dep.

Sandia National Laboratories (SNL) has developed a package for the on-site. transport of chemical munitions for the US Army. This package was designed to prevent the release of lethal quantities of chemical agents during transportation of munitions to the demilitarization facilities on-site. The packaging prevents auto-ignition of the munitions by limiting the thermal and structural assault on the munitions during an accident. This package, with some modifications to account for contents, may be suitable for the on-site transport of mixed wastes at United States Department of Energy

facilities. This paper discusses the design and verification testing of the package. The safety criteria for the package were modeled after the International Atomic Energy Agency (IAEA) hypothetical accident sequence and modified to take credit for operational controls. The modified accident sequence consisted of drop, puncture, and thermal events. The post-accident leak rate was established to prevent harm to an exposed worker. The packaging has a mass of 8600 kg and can accommodate up to 3600 kg of contents. The interior of the package is 188 cm in diameter and 232 cm long. Two sample ports can be used to sample the interior of the package prior to opening the closure and an o-ring test port can be used to determine the leak rates prior to and after transport.

4502 Nuclear Explosions and Explosives

Refer also to citation(s) 1573

1464 (CONF-9109114–Vol.1) **Sixth symposium on containment of underground nuclear explosions: Proceedings: Volume 1.** Olsen, C.W.; Price, M.E. (eds.). Lawrence Livermore National Lab., CA (United States). [1991]. 491p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. From 6. symposium on containment of underground nuclear explosions; Reno, NV (United States); 24-26 Sep 1991. Order Number DE92041091. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This is Volume 1 of two unclassified volumes of the Proceedings of the Sixth Symposium on Containment of Underground Nuclear Explosions. The symposium, held September 24–27, 1991 in Reno, Nevada, was a meeting of workers from all levels in the containment community. Papers on containment and related geological, geophysical, engineering, chemical, and computational topics were included.

1465 (CONF-9109114–Vol.2) **Sixth symposium on containment of underground nuclear explosions: Proceedings: Volume 2.** Olsen, C.W.; Price, M.E. (eds.). Lawrence Livermore National Lab., CA (United States). [1991]. 360p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. From 6. symposium on containment of underground nuclear explosions; Reno, NV (United States); 24-26 Sep 1991. Order Number DE92041092. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This is Volume 2 of two unclassified volumes of the Proceedings of the Sixth Symposium on Containment of Underground Nuclear Explosions. The Symposium, held September 24–27, 1991 in Reno, Nevada, was a meeting of workers from all levels in the containment community. Papers on containment and related geological, geophysical, engineering, chemical, and computational topics were included.

1466 (SAND–92-1011) **Technique for current step measurements on the low field Metal Oxide Varistor (MOV).** Jaramillo, R.A. Sandia National Labs., Albuquerque, NM (United States). Aug 1992. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93000843. Source: OSTI; NTIS; GPO Dep.

The low field (E≅2kV/cm) Metal Oxide Varistor (MOV) is a voltage regulation device. This report describes a technique for performing DC characteristic measurements on a MOV. The varistor is in the feedback loop of a high voltage operational amplifier. A current source forces a staircase current waveform through a MOV. An operational amplifier provides the required applied voltage to maintain the desired values of current through the varistor. The current values change at a maximum rate of 33.3 readings per second and a high speed voltmeter measures the varistor voltage. The maximum available current and voltage at present are 5 mA and 10 kV respectively. Examples of its use are with data from the MC3596 and XMC4317.

4504 Nuclear and Radiological Warfare

1467 (ORNL/TM–11917) **Analysis of the Spring-1990 two-meter box test bed experiments performed at the Army Pulse Radiation Facility (APRF).** Johnson, J.O.; Drischler, J.D.; Barnes, J.M. Oak Ridge National Lab., TN (United States). Aug 1992. 109p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92041388. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The capability to accurately assess and predict the effectiveness of radiation shielding materials in vehicles, structures, trenches, and other configurations is of considerable interest to the DoD and the DNA. A research effort involving several institutions has worked towards providing this capability for several years, resulting in the Monte Carlo Adjoint Shielding Code system - MASH. The purpose of this report is to present the results of a "benchmark" analysis of MASH against a set of measurements performed in the Spring of 1990 at the APRF and determine the capability of MASH in reproducing the measured neutron and gamma-ray dose data. In particular, the free-field environment was calculated along with measurements made using the "NATO standard test bed" (i.e. a two-meter box) and the RT-200 anthropormorphic phantom standing in the free-field and inside the two-meter box at the "NATO standard reference point" at 400 meters. The calculational results show mixed agreement with the measured data reported by the different teams of experimentalist. The neutron dose results indicate MASH consistently calculates more dose than was measured for both the phantom standing in the free-field and the phantom standing inside the two-meter box. The calculation/measurement differences were typically 20% to 30% for the phantom standing in the free-field and 10% to 20% for the phantom standing inside the two-meter box. The neutron reduction factors, however, typically agreed within ±20% for both phantom/box geometry configurations and orientations. With respect to the gamma-ray data, there were individual discrepancies between calculations and measurements however, typical agreement was within ±20%. The gamma-ray free-field environment at 400 meters continues to show a discrepancy between calculation and experiment which further manifest itself through the comparisons of the gamma-ray reduction factors.

1468 (ORNL/TM–11918) **Analysis of the spring 1991 two-meter box test bed experiments performed at the Army Pulse Radiation Facility (APRF).** Johnson, J.O.; Drischler, J.D.; Barnes, J.M. Oak Ridge National Lab., TN (United States). Sep 1992. 100p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract AC05-84OR21400. DNA MIPR-92-524. Order Number DE93000976. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The capability to accurately assess and predict the effectiveness of radiation shielding materials in vehicles, structures, trenches, and other configurations is of considerable interest to the DoD and the DNA. A research effort involving several institutions has worked towards providing this capability for several years, resulting in the Monte Carlo Adjoint Shielding Code system - MASH. The purpose of this report is to present the results of a "benchmark" analysis of MASH against a third set of measurements performed in the Spring of 1991 at the APRF and determine the capability of MASH in reproducing the measured neutron and gamma-ray integral data. In particular, the free-field environment was calculated along with measurements made using the "NATO standard test bed" (i.e. a two-meter box) and the RT-200 anthropormorphic phantom standing in the free-field and inside the two-meter box lined with 5% borated polyethylene at the "NATO standard reference point" at 400 meters. The calculational results show mixed agreement with the measured data reported by the different teams of experimentalists. ne neutron dose results indicate good agreement (typically ±20%) for the phantom standing in the free-field and excellent agreement (typically ±10%) for the phantom standing inside the two-meter box. The neutron reduction factors however, agreed for the phantom standing in the free-field but exhibited significant differences for the phantom standing inside the box. With respect to the gamma-ray data, there were individual discrepancies between calculations and measurements; however, typical agreement was within ±20%. The C/E comparisons for the gamma-ray free-field environment at 400 meters showed improved agreement between calculation and experiment relative to the same comparisons in the Fall 1989 and Spring 1990 studies.

4505 Strategic Defense Initiative

1469 (ANL/CP–76975) **Parallelizing the track-target model for the MIMD machine.** Zhong Xiong, W.; Swietlik, C. Argonne National Lab., IL (United States). [1992]. 4p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9210177–1: 1992 Institute of Electrical and Electronic Engineers (IEEE) system, man and cybernetics conference, Chicago, IL (United States), 18-21 Oct 1992). Order Number DE92041100. Source: OSTI; NTIS; GPO Dep.

Military Tracking-Target systems are important analysis tools for modelling the major functions of a strategic defense system operating against a ballistic missile threat during a simulated end-to-end scenario. As demands grow for modelling more trajectories with increasing numbers of missile types, so have demands for more processing power. Argonne National Laboratory has developed the parallel version of this Tracking-Target model. The parallel version has exhibited speedups of up to a factor of 6.3 resulting from a shared memory multiprocessor machine. This paper documents a project to implement the Tracking-Target model on a parallel processing environment.

1470 (SAND–92-1425C) **Results for the pyroshock ground test series for the STARS I and STARS II missile systems.** Cap, J.S. Sandia National Labs., Albuquerque, NM (United States). [1992]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-9210176–2: 63. shock and vibration symposium, Las Cruces, NM (United States), 27 Oct 1992). Order Number DE92040963. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The STARS (Strategic Targeting System) I and II missile programs have completed ground test series in order to establish the component and payload responses for the shock environments created by the various pyrotechnic skin and stage separation events. Deficiencies in instrumentation and procedures hampered the STARS I test program. Steps were implemented in the later STARS II test program to correct these deficiencies. The purpose of this paper is to present the results for these test programs with an emphasis on those improvements that produced the higher quality data. Examples of the resulting shock environments will be presented, and these results will be compared with the guidelines from the proposed Mil Handbook.

4506 Chemical and Biological

Refer also to citation(s) 753, 950, 1218

54 ENVIRONMENTAL SCIENCES

Refer also to citation(s) 1483, 1484, 1491

1471 (EUR–14088) **Environmental radioactivity measurement. Ispra 1990.** Dominici, G. (Commission of the European Communities, Ispra (Italy). Joint Research Centre); Risposi, L. Commission of the European Communities, Luxembourg (Luxembourg). 1992. 59p. (In Italian). Source: OSTI; NTIS (US Sales Only); INIS.

In this report there are briefly described the measurements of environmental radioactivity performed during 1990 by the site survey group of the Radioprotection Division at the Joint Research Centre Ispra Establishment. Data are give on the concentrations of Sr-90, Cs-137, HTO and other radionuclides in precipitation, air, waters, herbage, milk and radioactive effluents. The environmental contamination is mainly a consequence of the nuclear accident of Chernobyl.

5401 Environmental Sciences, Atmospheric

Refer also to citation(s) 71, 72, 73, 260, 437, 539, 611, 750, 758, 769, 773, 834, 837, 888, 889, 1145, 1199, 1232, 1552, 1558, 1584, 1585, 1586, 1632, 1637, 1639, 1757, 2425

1472 (ANL/CP–77170) **Evaluation of options for CO_2 capture/utilization/disposal.** Livengood, C.D.; Doctor, R.D. Argonne National Lab., IL (United States). [1992]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-920951–2: US Department of Energy contractors review meeting on gasification and gas stream cleanup systems, Morgantown, WV (United States), 15-17 Sep 1992). Order Number DE93000611. Source: OSTI; NTIS; GPO Dep.

The primary objective of this project is to develop in-depth engineering evaluations of technologies for the capture, use, and disposal of carbon dioxide (CO_2).This project emphasizes CO_2 capture technologies combined with integrated gasification combined-cycle (IGCC) power systems. Complementary evaluations will address CO_2 transportation, CO_2 use, and options for the longterm sequestration of unused Co_2. Commercially available CO_2-capture technology will provide performance and economic baselines for comparing innovative technologies. These results will then support recommendations for research and development to improve $C0_2$ capture and use, new process concepts, and optimized energy balances for $C0_2$ mitigation. Limited experimental research will provide data for evaluating new concepts.

1473 (ANL/CP–77207) **Methodology and emission scenarios employed in the development of the National Energy Strategy.** Fisher, R.E. Argonne National Lab., IL (United States). [1992]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9209160–7: International symposium on energy, environment and information management, Argonne, IL (United States), 15-18 Sep 1992). Order Number DE92041141. Source: OSTI; NTIS; INIS; GPO Dep.

This paper describes the steps taken to model the National Energy Strategy (NES). It provides an overview of the NES process including the models used for the project. The National Energy Strategy Environmental Analysis Model (NESEAM), which was used in analyzing environmental impacts, is discussed. The structure of NESEAM, as well as results and analyses are presented.

1474 (BNL–45879-Rev.) **Tropospheric sampling with aircraft.** Daum, P.H.; Springston, S.R. Brookhaven National Lab., Upton, NY (United States). Mar 1991. 45p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-900402–13-Rev.: 199. national meeting of the American Chemical Society (ACS), Boston, MA (United States), 22-27 Apr 1990). Order Number DE92041317. Source: OSTI; NTIS; GPO Dep.

Aircraft constitute a unique environment which places stringent requirements on the instruments used to measure the concentrations of atmospheric trace gases and aerosols. Some of these requirements such as minimization of size, weight, and power consumption are general; others are specific to individual techniques. This review presents the basic principles and considerations governing the deployment of trace gas and aerosol instrumentation on an aircraft. An overview of common instruments illustrates these points and provides guidelines for designing and using instruments on aircraft-based measurement programs.

1475 (CONF-930133–1) **Cloud amount and sunshine duration in the People's Republic of China, 1954–1988.** Kaiser, D. Oak Ridge National Lab., TN (United States). [1992]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 73. American Meteorological Society (AMS) annual meeting; Anaheim, CA (United States); 17-22 Jan 1993. Order Number DE92041023. Source: OSTI; NTIS; INIS; GPO Dep.

A part of the world with extensive records of cloudiness is the People's Republic of China (PRC). These data, along with records of other meteorological observations, have recently been made available through a joint research agreement established between the US Department of Energy (DOE) and the PRC Chinese Academy of Sciences (CAS) for the purpose of studying possible global warming due to an enhanced greenhouse effect. This paper examines the variation of PRC cloudiness, along with that of sunshine duration (a useful measure of cloudiness), over the 35-year period 1954–1988.

1476 (DOE/ER/60245–2) **Research on the seasonal snow of the Arctic Slope: Annual progress report, January 16, 1986–January 15, 1987.** Benson, C.S. Alaska Univ., Fairbanks, AK (United States). Geophysical Inst. [1987]. 11p. Sponsored by

USDOE, Washington, DC (United States). DOE Contract FG06-84ER60245. Order Number DE93001431. Source: OSTI; NTIS; GPO Dep.

This project deals with the seasonal snow on Alaska's Arctic Slope. Although it is concentrated on snow of the R_4D project area, it is important to relate the snow cover of this area with the rest of the Arctic Slope. The goals include determination of the amount of precipitation which comes as snow, the wind transport of this snow and its depositional pattern as influenced by drifting, the physical properties of the snow, the physical processes which operate in it, the proportions of it which go into evaporation, infiltration and runoff, and the biological role of the snow cover.

1477 (DOE/ER/60245–3) **Research on the seasonal snow of the Arctic Slope: Annual progress report, January 16, 1987–January 15, 1988.** Benson, C.S. Alaska Univ., Fairbanks, AK (United States). Geophysical Inst. [1988]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG06-84ER60245. Order Number DE93003039. Source: OSTI; NTIS; GPO Dep.

This project deals with the seasonal snow on Alaska's Arctic Slope. Although it is concentrated on snow of the R_4D project area, it is important to relate the snow cover of this area with the rest of the Arctic Slope. The goals include determination of the amount of precipitation which comes as snow, the wind transport of this snow and its depositional pattern as influenced by drifting, the physical properties of the snow, the physical processes which operate in it, the proportions of it which go into evaporation, infiltration and runoff, and the biological role of the snow cover. The 1984–1985, 1985–1986 and 1986–1987 seasonal snow was measured to determine its total quantity, its physical structure and its distribution as a function of wind and topography. Observations of meteorological parameters and snowpack characteristics during winter and spring have yielded information on the seasonal evolution of the snow in quantitative terms. A method of determining melt rates over large regions was developed and is being refined, progress was made on a model describing energy flux sources which control snow melting. A strong control is exerted by air mass advection on a broad scale. We are continuing to devote attention to the sources of energy and energy transfer mechanisms which control snow melt. The 1986 snow melt was two weeks later than the 1987 and 1985 meltouts. The delay was caused by advection of cold air from the Arctic Ocean. When it did get underway melting was very rapid and the snow pack disappeared in only half the time taken in 1985.

1478 (DOE/ER/60245–4) **Research on the seasonal snow of the Arctic Slope: Annual progress report, January 16, 1988–December 31, 1988.** Benson, C.S. Alaska Univ., Fairbanks, AK (United States). Geophysical Inst. [1988]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG06-84ER60245. Order Number DE93003040. Source: OSTI; NTIS; GPO Dep.

The original objectives of this research included a regional study of snow on the entire Arctic Slope. During the first year the scope was restricted to the R_4D area. In the second and third years the primary focus was also on the R_4D area,but measurements were made at Prudhoe Bay, Atgasuk and Wainwright to determine the flux of wind-blown snow on a wider scale. Additional broadening of scope was discussed at the San Diego R_4D meetings in April 1986 and 1987 and at the extrapolation workshop held at Penn State University in Spring 1987. The broadening of scope has also included detailed studies of chemistry and controls exerted by large-scale advection of air masses on the longwave, thermal IR, and radiation. The latter phenomena are critical in initiating snowmelt.

1479 (DOE/ER/60245–5) **Research on the seasonal snow of the Arctic Slope: Annual progress report, January 1, 1989–December 31, 1989.** Benson, C.S. Alaska Univ., Fairbanks, AK (United States). Geophysical Inst. [1989]. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG06-84ER60245. Order Number DE93003041. Source: OSTI; NTIS; GPO Dep.

This project deals with the seasonal snow on Alaska's Arctic Slope. Although it is concentrated on snow of the R40 project area, it is important to relate the snow cover of this area with the rest of the Arctic Slope. The goals include determination Of the amount of precipitation which comes as snow, the wind transport of this snow and its depositional pattern as influenced by drifting, the physical properties of the snow, the physical processes which operate in it, the proportions of it which go into evaporation, infiltration and runoff, and the biological role of the snow cover.

1480 (DOE/ER/60245–6) **Research on the seasonal snow of the Arctic Slope: Annual progress report, June 1, 1990–March 31, 1991.** Benson, C.S. Alaska Univ., Fairbanks, AK (United States). Geophysical Inst. [1991]. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG06-84ER60245. Order Number DE93003042. Source: OSTI; NTIS; GPO Dep.

This project deals with the seasonal snow on Alaska's Arctic Slope. Although it is concentrated on snow of the R_4D project area, it is important to relate the snow cover of this area with the rest of the Arctic Slope. The goals include determination of the amount of precipitation which comes as snow, the wind transport of this snow and its depositional pattern as influenced by drifting, the physical properties of the snow, the physical processes which operate in it, the proportions of it which go into evaporation, infiltration and runoff, and the biological role of the snow cover.

1481 (DOE/ER/60294–T2) **Participation of the Pennsylvania State University in the MAP3S precipitation chemistry network: Final report.** Lamb, D.; de Pena, R.G. Pennsylvania State Univ., University Park, PA (United States). Dept. of Meteorology. Apr 1991. 38p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-85ER60294. Order Number DE93001900. Source: OSTI; NTIS; INIS; GPO Dep.

The Meteorology Department of the Pennsylvania State University collected precipitation in central Pennsylvania for more than 14 years on behalf of the Multistate Atmospheric Power Production Pollution Study (MAP3S). The MAP3S protocol, based on the sampling of precipitation from individual meteorological events over a long period of time, has allowed both for the development of a chemical climatology of precipitation in the eastern region of the United States and for a vastly improved understanding of the atmospheric processes responsible for wet acidic deposition. The precipitation chemistry data from the Penn State MAP3S site provide evidence of links to the anthropogenic emissions of sulfur dioxide and oxidant precursors. There is now little doubt that the free acidity in the precipitation of the region is due to the presence of unneutralized sulfate in the aqueous phase. In the absence of significant sources of this sulfur species and in view of supplemental enrichment studies, it is concluded that the sulfate enters cloud and rain water primarily through the aqueous-phase oxidation of sulfur dioxide emitted into the air within the geographical region of deposition. Within the source region the local abundances of sulfur dioxide often exceed those of the oxidants, so the depositions of sulfate and free acidity tend to be modulated by the availability of the strong oxidants. As a consequence, the deposition of sulfate exhibits a very strong seasonal dependence and little response to changes in the emissions of sulfur dioxide.

1482 (DOE/ER/60294–T3) **Participation of the Pennsylvania State University in the MAP3S precipitation chemistry network: Final report.** Lamb, D.; de Pena, R.G. Pennsylvania State Univ., University Park, PA (United States). Dept. of Meteorology. Apr 1992. 38p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-85ER60294. Order Number DE93003108. Source: OSTI; NTIS; GPO Dep.

Precipitation in central Pennsylvania was collected for more than 14 years on behalf of the Multistate Atmospheric Power Production Pollution Study (MAP3S). The MAP3S protocol, based on the sampling of precipitation from individual meteorological events over a long period of time, has allowed both for the development of a chemical climatology of precipitation in the eastern region of the United States and for a vastly improved understanding of the atmospheric processes responsible for wet acidic deposition. The precipitation chemistry data from the Penn State MAP3S site provide evidence of links to the anthropogenic emissions of sulfur dioxide and oxidant precursors. There is now little doubt that the free acidity in the precipitation of the region is due to the presence of unneutralized sulfate in the aqueous phase. In the absence of

significant sources of this sulfur species and in view of supplemental enrichment studies, it is concluded that the sulfate enters cloud and rain water primarily through the aqueous-phase oxidation of sulfur dioxide emitted into the air within the geographical region of deposition. Within the source region the local abundances of sulfur dioxide often exceed those of the oxidants, so the depositions of sulfate and free acidity tend to be modulated by the availability of the strong oxidants. As a consequence, the deposition of sulfate exhibits a very strong seasonal dependence and little response to changes in the emissions of sulfur dioxide.

1483 (DOE/ER/60304–8) **Sensitivity of climate models: Comparison of simulated and observed patterns for past climates: Progress report, February 1, 1992–January 31, 1993.** Prell, W.L.; Webb, T. III. Brown Univ., Providence, RI (United States). Aug 1992. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-85ER60304. Order Number DE93000893. Source: OSTI; NTIS; INIS; GPO Dep.

Predicting the potential climatic effects of increased concentrations of atmospheric carbon dioxide requires the continuing development of climate models. Confidence in the predictions will be much enhanced once the models are thoroughly tested in terms of their ability to simulate climates that differ significantly from today's climate. As one index of the magnitude of past climate change, the global mean temperature increase during the past 18,000 years is similar to that predicted for carbon dioxide–doubling. Simulating the climatic changes of the past 18,000 years, as well as the warmer-than-present climate of 6000 years ago and the climate of the last interglacial, around 126,000 years ago, provides an excellent opportunity to test the models that are being used in global climate change research. During the past several years, we have used paleoclimatic data to test the accuracy of the National Center for Atmospheric Research, Community Climate Model, Version 0, after changing its boundary conditions to those appropriate for past climates. We have assembled regional and near-global paleoclimatic data sets of pollen, lake level, and marine plankton data and calibrated many of the data in terms of climatic variables. We have also developed methods that permit direct quantitative comparisons between the data and model results. Our research has shown that comparing the model results with the data is an evolutionary process, because the models, the data, and the methods for comparison are continually being improved. During 1992, we have completed new modeling experiments, further analyzed previous model experiments, compiled new paleodata, made new comparisons between data and model results, and participated in workshops on paleoclimatic modeling.

1484 (DOE/ER/60422–7) **Natural and anthropogenic climate change: Final report, 1 March 1986–31 August 1992.** Portman, D.A.; Gutowski, W.J. Jr.; Wang, W.C.; Iacono, M.J.; Yang, S. Atmospheric and Environmental Research, Inc., Cambridge, MA (United States). 31 Aug 1992. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-86ER60422. Order Number DE93000898. Source: OSTI; NTIS; INIS; GPO Dep.

This final report provides a broad overview of program accomplishments. Brief descriptions are provided for accomplishments with respect to intercomparisions and improvements in general circulation models, analysis of climatic data and climate model statistics, and accomplishments in the China Meteorology coordination.

1485 (DOE/ER/61057–2) **High spectral resolution measurements for the ARM Program: Year two technical progress report, March 15, 1991–March 15, 1992.** Revercomb, H.E. Wisconsin Univ., Madison, WI (United States). Space Science and Engineering Center. 22 May 1992. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-90ER61057. Order Number DE93002772. Source: OSTI; NTIS; GPO Dep.

This report focuses on the design and fabrication of high spectral resolution FTIR (Fourier Transform Infrared) instrumentation for the CART sites of the Atmospheric Radiation Measurement (ARM) Program. The ultimate objective of this grant is to develop three different types of instruments, named the AERI, AERI-X, and SORT. The Atmospheric Emitted Radiance Interferometer (AERI) is the simplest. It will be available for early deployment at the first ARM site and will be deployable at several locations in the extended network to give horizontal coverage. The AERI will be an 0.5 cm^{-1} resolution instrument, which measures accurately calibrated radiance spectra for radiation studies and for remote sensing of atmospheric state variables. The AERI-X and the SORTI are higher spectral resolution instruments for obtaining the highest practical resolution for spectroscopy at the ARM central sites. The AERI-X, like the AERI will measure atmospheric emitted radiance, but with resolutions as high as 0.1 cm^{-1}. The Solar Radiance Transmission Interferometer will measure the total transmission of the atmosphere by tracking the sun through changes in atmospheric air mass. The large solar signal makes it practical for this instrument to offer the ultimate in spectral resolution, about 0.002 cm^{-1}.

1486 (DOE/ER/61059–1) **Cloud and aerosol characterization for the ARM central facility: Multiple remote sensor techniques development: Technical progress report.** Sassen, K. Utah Univ., Salt Lake City, UT (United States). Dept. of Meteorology. 30 Apr 1992. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-90ER61059. Order Number DE93000915. Source: OSTI; NTIS; GPO Dep.

This research project designed to investigate how atmospheric remote sensing technology can best be applied to the characterization of the cloudy atmosphere. Our research program addresses basic atmospheric remote sensing questions, but at the same time is clearly directed toward providing information crucial to the ARM (Atmospheric Remote Sensing) program and for application to the Clouds and Radiation Testbed (CART). The instrumentation that is being brought into play includes a variety of art-of-the-art sensors. Available at NOAA WPL are polarization Doppler K_a-band (0.86 mm) and X-band (3.2 cm) radars, a $C0_2$(10.6 μm) Doppler lidar with sequential ' polarization measurement capabilities, a three-channel (20.6, 31.65 and 90 GHz) microwave radiometer, and variety of visible and infrared radiometers. Instrumentation at the University of Utah Facility for Atmospheric Remote Sensing (FARS) includes a polarization ruby (0.643 μm) lidar, a narrow-beam (0.14°) mid-infrared (9.5–11.5 μm) radiometer coaligned with the lidar, several other radiometers in the visible and infrared spectral regions, and an advanced two-color (1.06 and 0.532 μm), four-channel Polarization Diversity Lidar (PDL) and all-sky video imaging system that have only recently been developed under the ARM IDP.

1487 (DOE/ER/61065–2) **Testbed model and data assimilation for ARM: Progress report No. 2, 1 March 1991–31 August 1992 (revised).** Louis, J.F. Atmospheric and Environmental Research, Inc., Cambridge, MA (United States). 22 Sep 1992. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-90ER61065. Order Number DE93001792. Source: OSTI; NTIS; INIS; GPO Dep.

The objectives of this contract are to further develop and test the ALFA (AER Local Forecast and Assimilation) model originally designed at AER for local weather prediction and apply it to three distinct but related purposes in connection with the Atmospheric Radiation Measurement (ARM) program: (a) to provide a testbed that simulates a global climate model in order to facilitate the development and testing of new cloud parametrizations and radiation models; (b) to assimilate the ARM data continuously at the scale of a climate model, using the adjoint method, thus providing the initial conditions and verification data for testing parameumtions; (c) to study the sensitivity of a radiation scheme to cloud parameters, again using the adjoint method, thus demonstrating the usefulness of the testbed model. The data assimilation will use a variational technique that minimizes the difference between the model results and the observation during the analysis period. The adjoint model is used to compute the gradient of a measure of the model errors with respect to nudging terms that are added to the equations to force the model output closer to the data. The radiation scheme that will be included in the basic ALFA model makes use of a gen two-stream approximation, and is designed for vertically inhonogeneous, multiple-scattering atmospheres. The sensitivity of this model to the definition of cloud parameters will be studied. The adjoint technique will also be used to compute the sensitivities. This project is designed to provide the Science Team members with the appropriate tools and modeling environment for proper testing and

tuning of new radiation models and cloud parametrization schemes.

1488 (DOE/ER/61361–1) **Parameterization of GCM Subgrid nonprecipitating cumulus and stratocumulus clouds using stochastic/phenomenological methods: Annual technical progress report, 1 December 1991–30 November 1992.** Stull, R.B. Wisconsin Univ., Madison, WI (United States). Dept. of Atmospheric and Oceanic Sciences. 26 Aug 1992. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-92ER61361. Order Number DE93000424. Source: OSTI; NTIS; GPO Dep.

A theory was developed for the fraction of near-surface air likely to form forced and active cumulus clouds. This stochastic method is based on a 2-D frequency distribution of the occurrence of various buoyancy and condensation levels in air near the surface, and the relationship of this distribution to the mean temperature profile. An alternative form of this theory utilizes a 2-D distribution of convective available potential energies (CAPE) instead of virtual potential temperatures.

1489 (DOE/NV/10630–33-Vol.1) **US Department of Energy Nevada Field Office annual site environmental report, 1991: Volume 1.** Black, S.C.; Latham, A.R.; Townsend, Y.E. (eds.). Reynolds Electrical and Engineering Co., Inc., Las Vegas, NV (United States). Sep 1992. 339p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC08-89NV10630. Order Number DE93002977. Source: OSTI; NTIS; INIS; GPO Dep.

Monitoring and surveillance on and around the Nevada Test Site (NTS) by DOE contractors and Site user organizations during 1991 indicated that underground nuclear testing operations were conducted in compliance with regulations, i.e., the dose the maximally exposed offsite individual could have received was less than 0.09 percent of the guideline for air exposure. All discharges of radioactive liquids remained onsite in containment ponds, and there was no indication of potential migration of radioactivity to the offsite area through groundwater. Surveillance around the NTS Indicated that airborne radioactivity from test operations was not detectable off site, and no measurable net exposure to members of the offsite population was detected through the offsite dosimetry program. The calculated maximum effective dose equivalent off site would have been 8.6×10^{-3} mrem. Any person receiving this dose was also exposed to 142 mrem from natural background radiation. There were no nonradiological releases to the offsite area. Hazardous wastes were shipped to EPA approved disposal facilities. Compliance with the various regulations stemming from the National Environmental Policy Act Is being achieved and, where mandated, permits for air and water discharges and waste management have been obtained from the appropriate agencies. Non-NTS support facilities complied with the requirements of air quality permits and state or local wastewater discharge and hazardous waste permits.

1490 (DOE/NV/10630–33-Vol.2) **US Department of Energy Nevada Field Office annual site environmental report, 1991: Volume 2, Appendices.** Black, S.C.; Latham, A.R.; Townsend, Y.E. (eds.). Reynolds Electrical and Engineering Co., Inc., Las Vegas, NV (United States). Sep 1992. 329p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC08-89NV10630. Order Number DE93002978. Source: OSTI; NTIS; INIS; GPO Dep.

These appendices contain 1991 Nevada Test Site (NTS) onsite and offsite milk environmental monitoring results. The onsite data presented are accompanied by summaries of statistical evaluation of the data. Other offsite data collected by the EPA are available from the US Environmental Protection Agency, Environmental Monitoring Systems Laboratory, Las Vegas, Nevada.

1491 (DOE/PE–0105P) **Climate change and related activities.** USDOE, Washington, DC (United States). [1992]. 17p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93000477. Source: OSTI; NTIS; INIS; GPO Dep.

The production and consumption of energy contributes to the concentration of greenhouse gases in the atmosphere and is the focus of other environmental concerns as well. Yet the use of energy contributes to worldwide economic growth and development. If we are to achieve environmentally sound economic growth, we must develop and deploy energy technologies that contribute to global stewardship. The Department of Energy carries out an aggressive scientific research program to address some of the key uncertainties associated with the climate change issue. Of course, research simply to study the science of global climate change is not enough. At the heart of any regime of cost-effective actions to address the possibility of global climate change will be a panoply of new technologies-technologies both to provide the services we demand and to use energy more efficiently than in the past. These, too, are important areas of responsibility for the Department. This report is a brief description of the Department's activities in scientific research, technology development, policy studies, and international cooperation that are directly related to or have some bearing on the issue of global climate change.

1492 (EGG–10617-1151) **Development and validation of atmospheric dispersion models for ideal gases and hydrogen fluoride: Part 1, Technical reference manual.** McFarlane, K. (Shell Research Ltd., Chester (United Kingdom). Thornton Research Centre); Prothero, A.; Puttock, J.S.; Roberts, P.T.; Witlox, H.W.M. EG and G Energy Measurements, Inc., Las Vegas, NV (United States); Shell Research Ltd., Chester (United Kingdom). Thornton Research Centre. Nov 1990. 690p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC08-88NV10617. Order Number DE93000953. Source: OSTI; NTIS (documentation only); ESTSC (complete software package), P.O. Box 1020, Oak Ridge, TN 37831-1020; GPO Dep.

The thermodynamic behavior of hydrogen fluoride when diluted with air, particularly moist air, is very different from that of a simple ideal gas. The gas-air mixture can, depending on conditions, be denser than ambient air or substantially less dense than air. This behavior of an HF cloud would have a major influence on the dispersion behavior of HF in the atmosphere if it were released accidentally. For gases such as LNG thermodynamic effects must be included in dispersion models in order to accurately simulate such releases. Because of the unique thermodynamic properties of HF, it was felt that those properties would be important in accurately simulating an HF release. This program identified three major areas in which substantial uncertainties existed in previous models: (1) the modeling of the complex thermodynamics of HF/H_2O/Air mixtures (including aerosol effects on cloud density); (2) the treatment of a wide range of surface roughness conditions (including possible multiple surface roughness conditions) and (3) jet flow and air entrainment for pressurized releases of HF, followed by transition to ground-based dense gas dispersion. Major objectives of this study were to develop and validate computer-based models to calculate the release properties in addition to simulating jet and plume behavior downwind of an accidental release of HF.

1493 (ETDE-IT–92-86) **Pollution transport event in Italian Alps: Monitoring, measurement and analysis.** Marcazzan, G.M.; Maugeri, M.; Bonelli, P. Milan Univ. (Italy). Ist. di Fisica Generale Applicata; Ente Nazionale per l'Energia Elettrica, Milan (Italy). Centro Termica e Nucleare. 1990. 16p. (In Italian). Order Number DE93729446. Source: OSTI; NTIS (US Sales Only); INIS.

The study of long range transport of aerosol pollution is a field of increasing interest. Within the framework of a program of aerosol characterization in urban areas and remote sites, a pollution transport event was identified through concentration analysis of some tracer elements in particulate matter. PIXE and PIGE code analyses of the concentrations of some elements of atmospheric particulate collected in Milan showed unusually high concentrations of S, Zn, V, Ni, and K in the period 30/6/87-2/7/87. After some days (3/7/87-5/7/87), very high concentrations of the same elements were measured also in the samples collected in a mountain station (Sestriere) situated 200 km west of Milan. The analysis of the anemological situation showed a systematic tendency of the flow to move slowly speed eastward in the whole Po Valley, suggesting the hypothesis of an event of long range pollution transport. The analysis of the daily maximum mixing depth and the calculation of back and forward trajectories supported this hypothesis.

1494 (ETDE-IT–92-88) **Air mass identification in relation to pollution episodes in Italian Alps.** Anfossi, D.; Novo, A.; Rossi, G.C.; Villone, B. Consiglio Nazionale delle Ricerche, Turin (Italy). Lab. di Cosmo-Geofisica; Ente Nazionale per l'Energia Elettrica, Milan (Italy). Centro Termica e Nucleare; Ente Nazionale per

l'Energia Elettrica, Milan (Italy). Centro di Ricerca Idraulica e Strutturale. 1991. 8p. Order Number DE93729448. Source: OSTI; NTIS (US Sales Only).

During 1990, the Eurotrac research group analyzed chemical and meteorological data of the Stubai intercomparison sampling exercise (performed the previous year); sampled twice the snow at Sestriere and Glacier Careser; and performed the chemical analysis of the collected samples. The aim of the research was to trying to interpret, from a meteorological stand-point, the concentration of compounds of particular interest found in the above snow samples. This was performed by means of an air mass trajectory model based on the ECMWF analysis.

1495 (EUR–13369) **A survey of nitrogen dioxide in Paris. July 1989 - January 1990.** Atkins, D.H.F.; Quirino, I. Commission of the European Communities, Luxembourg (Luxembourg). 1992. 59p. Source: OSTI; NTIS (US Sales Only).

A survey of NO_2 has been carried out in the Paris area using simple passive diffusion tube samplers. These samplers were exposed at sites across the city in areas designated as background, where the NO_2 concentration is locally representative (i.e. > 50 m from significant sources of NO_2 such as busy roads). The density of sites was highest in the city centre of Paris, decreasing to the outer suburbs. Sampling was carried out for seven consecutive four-week sampling periods starting in July 1989. Data were mapped by computer in three intervals: the summer season (July-September inclusive), the winter (October-January) and the whole survey which, spanning the interval from midwinter to midsummer could, with some reservations, be equated with the annual average. Nitrogen dioxide concentrations were greater in the winter but nevertheless all maps showed broadly similar features with highest concentrations in central Paris.

1496 (IGC–125) **Atmospheric studies with SODAR at Kalpakkam.** Somayaji, K.M. Indira Gandhi Centre for Atomic Research, Kalpakkam (India). 1991. 70p. Order Number DE93605544. Source: OSTI; NTIS (US Sales Only); INIS.

A doppler SODAR for measurement of wind characteristics at different heights has been installed at HASL, IGCAR, Kalpakkam and is in operation since January 1990. The technical specifications and the basic aspects of SODAR, siting considerations and installation details are given. The report also discusses some observations regarding the site selection, installation and operation of SODARs. The basic theory of SODARs, some aspects of turbulence and dispersion in atmosphere and the various stability classification schemes are outlined. Some details regarding land/sea-breeze circulations and inversions are also given. (author). 6 refs., 10 figs., 8 annextures.

1497 (KTM/E-B–114) **Economic effects of carbon dioxide emission abatement: Economic effects in Finland.** Maeenpaeae, I.; Tervo, H. Ministry of Trade and Industry, Helsinki (Finland). 1992. 75p. (In Finnish). Project KTM-22/881/91. Order Number DE93721610. Source: OSTI; NTIS.

Analysis is based on the results of FMS model system, the Finnish long term Model System. FMS is multisectoral equilibrium growth model. During the research project a comprehensive energy consumption and production sub-model was constructed, where the options and costs of energy saving and the structures of electricity and heat production are depicted. The fuel use of energy consumption and production is joined with air emissions and economic policy measure links. As measures of reduction of CO2 emissions carton tax, subsidies to energy saving investments and basic plant alternatives in electricity production are analyzed. The domestic carton tax deteriorates foreign competitiveness if the other cost factors of the economy do not adapt. In the analysis where either the wage rate or the terms of trade adjust in such a way that the average price level of the economy in terms of the foreign price level does not change, even a considerable carbon tax does not deteriorate exports and lead to the fall of the level of the economic activity. The international carbon tax causes price rise of commodities in the same way as in Finland. Then the competitiveness of Finland does not deteriorate. The terms of trade of Finland improves instead which has favourable effects to the economic growth. Three alternatives in electricity production are compared, normalized 1000 MW coal, nuclear and natural gas stations. In the conditions of the reference scenario the nuclear power stations diminishes CO2 emissions about 8 % and the natural gas station 4 %. The nuclear power station yields a little bit greater level of the economic activity than the coal station and natural gas a bit lower level.

1498 (LBL–31916) **Volatile organic chemical emissions from carpets: Final report.** Hodgson, A.T.; Wooley, J.D.; Daisey, J.M. Lawrence Berkeley Lab., CA (United States). Apr 1992. 122p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. Order Number DE93001581. Source: OSTI; NTIS; GPO Dep.

The primary objective of this research, was to measure the emission rates of selected individual VOC, including low molecular-weight aldehydes, released by samples of four new carpets that are typical of the major types of carpets used in residences, schools and offices. The carpet samples were collected directly from the manufacturers' mills and packaged to preserve their chemical integrity. The measurements of the concentrations and emission rates of these compounds were made under simulated indoor conditions in a 20-M^3 environmental chamber designed specifically for investigations of VOC. The measurements were conducted over a period of one week following the installation of the carpet samples in the chamber. Duplicate experiments were conducted for one carpet. In addition, the concentrations and emission rates of VOC resulting from the installation of a new carpet in a residence were measured over a period of seven weeks. The stabilities of the week-long ventilation rates and temperatures were one percent relative standard deviation. The four carpets emitted a variety of VOC, 40 of which were positively identified. Eight of these were considered to be dominant. They were (in order of chromatographic retention time) formaldehyde, vinyl acetate, 2,2,4-trimethylpentane (isooctane), 1,2-propanediol (propylene glycol), styrene, 2-ethyl-l-hexanol, 4-phenylcyclohexene (4-PCH), and 2,6 di-tert-butyl-4-methylphenol (BHT). With the exception of formaldehyde, only limited data are available on the toxicity and irritancy of these compounds at low concentrations. Therefore, it is difficult to determine at this time the potential magnitude of the health and comfort effects that may occur among the population from exposures to emissions from new carpets. The concentrations and emission rates of most compounds decreased rapidly over the first 12 h of the experiments.

1499 (NEI-DK–954) **Interference from acid gases in relation to the measurement of dust concentrations.** Holm Christensen, B. (dk-TEKNIK (DK)). Danske Elvaerkers Forening, Copenhagen (Denmark). Kraftvaerkernes Miljoeudvalg, Stofemissionsgruppen. 1990 53p. (In Danish). Order Number DE93721380. Source: OSTI; NTIS.

Acid gases can interfere with measurement of dust by binding to particles that are collected in the filter used for taking samples or to the actual filter material. If the acid gases have bound themselves to the particles before these are taken out of the chimney, this is called interference. Measurements were taken on blok 3 of Amagervaerket, a power station located on the outskirts of Copenhagen, Denmark, in order to ascertain the extent of interference with regard to measurement of dust from modern coal-fired power plants and to test various methods of measurement. It was found that the concentration of sulphates on the collected particles generally lay under a concentration in the flue gas answering to 1 mg per cubic meter (n,t) flue gas at 12% carbon dioxide. It could be possible that the amount of sulphates results from interference from SO_2 and SO_3. HCl was not found bound to particles to an extent that made detection possible. Interference in connection with measurings taken on electrofilters and scrubbers are evaluated to be 0-11% of the particle concentration. Average particle concentration was 8.5 mg per cubic meter (n,t) which means an interference of 0-0.85 mg per cubic meter (n,t). In the there were chimney lower particle concentrations, but a higher percentage of sulphate on the particles. The traditional gravimetric particle measuring method is recommended combined with extraction of filter and filter cake APA method 5F with following sulphate analysis of the extract. This method can only show how large the maximum interference is. (AB).

1500 (ORNL/CDIAC–48) **Carbon Dioxide Information Analysis Center: FY 1991 activities.** Cushman, R.M.; Stoss, F.W.

Oak Ridge National Lab., TN (United States). Carbon Dioxide Information Analysis Center. Jun 1992. 81p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92041010. Source: OSTI; NTIS; GPO Dep.

Environmental Sciences Division Publication No. 3788.

During the course of a fiscal year, Oak Ridge National Laboratory's Carbon Dioxide Information Analysis Center (CDIAC) distributes thousands of specially publications-numeric data packages (NDPs), computer model packages (CMPs), technical reports, public communication publications, newsletters, article reprints, and reference books-in response to requests for information related to global environmental issues, primarily those pertaining to climate change. CDIAC's staff also provides technical responses to specific inquiries related to carbon dioxide (CO_2), other trace gases, and climate. Hundreds of referrals to other researchers, policy analysts, information specialists, or organizations are also facilitated by CDIAC's staff. This report provides an account of the activities accomplished by CDIAC during the period October 1, 1990 to September 30, 1991. An organizational overview of CDIAC and its staff is supplemented by a detailed description of inquiries received and CDIAC's response to those inquiries. An analysis and description of the preparation and distribution of numeric data packages, computer model packages, technical reports, newsletters, factsheets, specially publications, and reprints is provided. Comments and descriptions of CDIAC's information management systems, professional networking, and special bilateral agreements are also described.

1501 (ORNL/CDIAC–53) **The Global Historical Climatology Network: Long-term monthly temperature, precipitation, sea level pressure, and station pressure data.** Vose, R.S. (Tennessee Univ., Knoxville, TN (United States). Energy, Environment and Resources Center); Schmoyer, R.L.; Steurer, P.M.; Peterson, T.C.; Heim, R.; Karl, T.R.; Eischeid, J.K. Oak Ridge National Lab., TN (United States). Carbon Dioxide Information Analysis Center. Jul 1992. 317p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. (NDP–041). Order Number DE92040521. Source: OSTI; NTIS; GPO Dep.

Environmental Sciences Division Publication No. 3912.

Interest in global climate change has risen dramatically during the last several years. In a similar fashion, the number of data sets available to study global change has also increased. Unfortunately, these data sets have been compiled by many different organizations/researchers, making it confusing and time consuming for individual researchers to acquire the "best" data. In response to this rapid growth in the number of global data sets, the Carbon Dioxide Information Analysis Center (CDIAC) and the National Climatic Data Center (NCDC) commenced the Global Historical Climatology Network (GHCN) project. The purpose of this project is to compile an improved global base-line data set of long-term monthly mean temperature, precipitation, sea level pressure, and station pressure for a dense network. of worldwide meteorological stations. Specifically, the GHCN project seeks to consolidate the numerous preexisting national-, regional-, and global-scale data sets into a single global climate data base that can be updated, enhanced, and distributed at regular intervals. The first version of the GHCN data base was completed during the summer of 1992. It contains 6039 temperature, 7533 precipitation, 1883 sea level pressure, and 1873 station pressure stations. All stations have at least 10 years of data, 40% have more than 50 years of data, and 10% have more than 100 years of data. Spatial coverage is good over most of the globe, particularly for the United States and central Europe. In comparison to other major global data sets, dramatic improvements are evident over South America, Africa, and Asia. The GHCN data base is available as a Numeric Data Package (NDP) from CDIAC. The NDP consists of this document and two magnetic tapes that contain machine-readable data files and accompanying retrieval codes. This document describes, in detail, both the GHCN data base and the contents of the magnetic tap

1502 (PNL-SA–20951) **Modeling the uncertain impacts of climate change.** Liebetrau, A.M. Pacific Northwest Lab., Richland, WA (United States). Aug 1992. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-9208149–1: 3. International Environmetrics Society (IES) conference, Espoo (Finland), 17-21 Aug 1992). Order Number DE92041339. Source: OSTI; NTIS; INIS; GPO Dep.

Human and earth systems are extremely complex processes. The modeling of these systems to assess the effects of climate change is an activity fraught with uncertainty. System models typically involve the linking of a series of computer codes, each of which is a detailed model of some physical or social process in its own right. In such system models, the output from one process model is the input to another. Traditional methods for dealing with uncertainty are inadequate because of the sheer complexity of the modeling effort: Monte Carlo methods and the exhaustive evaluation of "what if?" scenarios estimate sensitivities fail because of the heavy computational burden. More efficient methods are required for learning about system models that are constructed from a collection of computer codes. A two-tiered modeling approach is being developed to estimate the distribution of outcomes from a series of nested models. The basic strategy is to develop a simplified executive, or simplified system code (SSC), that is analogous to the more complex underlying code. An essential feature of the SSC is that it uses information abstracted from the detailed underlying process codes in a manner that preserves their essential features and interactions among them. Of course, to be useful, the SSC must be much faster to run than its complex counterpart. The success of the SSC modeling strategy depends on the methods used to extract essential features of the complex underlying codes.

1503 (SAND–92-2069) **Description and validation of ERAD: An atmospheric dispersion model for high explosive detonations.** Boughton, B.A.; DeLaurentis, J.M. Sandia National Labs., Albuquerque, NM (United States). Oct 1992. 80p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93002515. Source: OSTI; NTIS; GPO Dep.

The Explosive Release Atmospheric Dispersion (ERAD) model is a three-dimensional numerical simulation of turbulent atmospheric transport and diffusion. An integral plume rise technique is used to provide a description of the physical and thermodynamic properties of the cloud of warm gases formed when the explosive detonates. Particle dispersion is treated as a stochastic process which is simulated using a discrete time Lagrangian Monte Carlo method. The stochastic process approach permits a more fundamental treatment of buoyancy effects, calm winds and spatial variations in meteorological conditions. Computational requirements of the three-dimensional simulation are substantially reduced by using a conceptualization in which each Monte Carlo particle represents a small puff that spreads according to a Gaussian law in the horizontal directions. ERAD was evaluated against dosage and deposition measurements obtained during Operation Roller Coaster. The predicted contour areas average within about 50% of the observations. The validation results confirm the model's representation of the physical processes.

1504 (SA-PUB–9/89-Vol.1) **Conference on climate and water: Volume 1.** Huttunen, L. (ed.). Academy of Finland, Helsinki (Finland). 1989. 520p. (CONF-8909491–Vol.1: Conference on climate and water, Helsinki (Finland), 11-15 Sep 1989). Order Number DE93721620. Source: OSTI; NTIS; INIS.

This book contains the Proceedings of the Conference on Climate and Water under the following groupings: Understanding the climate systems - its variability and potential for change; Climate and hydrological cycle - the effects of climate variability and Change.

1505 (SA-PUB–9/89-Vol.1, pp. 9-30) **Climatic conditions of the future.** Budyko, M.I. (State Hydrological Institute, Leningrad (USSR). Research Dept.). Academy of Finland, Helsinki (Finland). 1989. (CONF-8909491–Vol.1: Conference on climate and water, Helsinki (Finland), 11-15 Sep 1989). In *Conference on climate and water: Volume 1.* 520p. Order Number DE93721620. Source: OSTI; NTIS.

All the existing methods of evaluating future climates being approximate (with errors of these evaluations difficult to determine), the evident way to choose to solve the above mentioned problem is to use the approach traditionally applied in many fields of science which is based on comparing the results of two or more independent methods of calculations. Good agreement of these results can

serve as a proof of their being valid. One of the variants of such an approach while predicting future climatic conditions is to compare the results of theoretical calculations by climate simulations with the results obtained by empirical methods, climate analogue method having acquired by now the principal meaning. The latter method is based on using the materials on paleoclimatic warm intervals as demonstrating the possible patterns of meteorological elements regime in the future with the similar level of global warming.

1506 (SA-PUB–9/89-Vol.1, pp. 73-92) **Simulation of the impact of CO_2 atmospheric doubling on precipitation and evapotranspiration - study of the sensitivity to various hypotheses.** Bultot, F. (Royal Meteorological Institute of Belgium (Belgium). Hydrology Section); Gellens, D. Academy of Finland, Helsinki (Finland). 1989. (CONF-8909491–Vol.1: Conference on climate and water, Helsinki (Finland), 11-15 Sep 1989). In *Conference on climate and water: Volume 1.* 520p. Order Number DE93721620. Source: OSTI; NTIS.

In the $2xCO_2$ scenarios, based on the results yielded by General Circulation Models, and currently used to simulate the hydrological impact, two hypotheses are generally made. One of these is that the number of precipitation days remains unchanged. The increased precipitation amounts in the winter season imply increased precipitation intensities, and oppositely, the decreased amounts in the summer season, decreased intensities. The second hypothesis deals with the relative humidity. This element is kept equal to its present value. Hence, the increased temperature implies increased values of both the water vapour pressure and the saturation deficit. This leads to greater values of the potential evapotranspiration and consequently of the effective evapotranspiration. The present study focuses on the sensitivity of the results, got for Belgium, to specific modifications made in the above-mentioned hypotheses. On the one hand, the frequency of precipitation days is no longer kept constant but set to vary in terms of the monthly precipitation amount. On the other hand, the water vapour pressure is estimated by assuming that the relative humidity reaches 95 %, 100 %, 105 % and 110 % of its present value. These sensitivity studies are reported for two typical basins in Belgium.

1507 (SA-PUB–9/89-Vol.1, pp. 93-102) **Long-term variability of precipitation in Austria.** Behr, O. (Universitaet Wien, (Austria). Institut fuer Hydraulik, Gewaesserkunde und Wasserwirtschaft). Academy of Finland, Helsinki (Finland). 1989. (CONF-8909491–Vol.1: Conference on climate and water, Helsinki (Finland), 11-15 Sep 1989). In *Conference on climate and water: Volume 1.* 520p. Order Number DE93721620. Source: OSTI; NTIS.

Long-term characteristics of precipitation are a major input variable to many problems in water management. Fluctuations of long time series together with regional variability, therefore, have been investigated in Austria using monthly precipitation data. The results indicate spatial patterns of long-term variability dominated by the Alps. It was shown that annual or even seasonal values may be insufficient for assessing trends. Thus monthly data should be preferred. Observation data also indicates that the conventional conception of a stable long-term mean does not apply to precipitation and thus a careful consideration of variability of precipitation is indispensable. The problems of assessing the long-term spatial patterns of precipitation fluctuations in an area as small as Austria led to a joint project of all Danube countries within the framework of the International Hydrological Program of UNESCO in 1988.

1508 (SA-PUB–9/89-Vol.1, pp. 31-50) **Projected climatic changes and impacts in Europe due to increased Co_2.** Bach, W. (University of Muenster (Germany, F.R.). Center for Applied Climatology and Environmental Studies). Academy of Finland, Helsinki (Finland). 1989. (CONF-8909491–Vol.1: Conference on climate and water, Helsinki (Finland), 11-15 Sep 1989). In *Conference on climate and water: Volume 1.* 520p. Order Number DE93721620. Source: OSTI; NTIS.

An overview of the observed climate changes in the recent past is given in this paper. This is followed by highlighting the projected climatic changes using scenario analysis based on general circulations models. The climatic change and impact analyses concentrate on the European scene. The paper ends by listing the priorities of the required political action.

1509 (SA-PUB–9/89-Vol.1, pp. 103-110) **Long-term variations of the water balance in Sweden: A preliminary study.** Jutman, T. (Swedish Meteorological and Hydrological Inst., Norrkoeping (Sweden)); Bergstroem, S.; Eriksson, B. Academy of Finland, Helsinki (Finland). 1989. (CONF-8909491–Vol.1: Conference on climate and water, Helsinki (Finland), 11-15 Sep 1989). In *Conference on climate and water: Volume 1.* 520p. Order Number DE93721620. Source: OSTI; NTIS.

950preliminary statistical analysis of records of precipitation, runoff and forest biomass is made to detect trends and interactions. Because of the risk of inconsistencies in the data the analysis is mainly restricted to the period 1945 - 1987. The results indicate a possible increase of evapotranspiration due to increasing forest biomass. Further studies are, however, needed before any definite conclusions can be drawn.

1510 (SA-PUB–9/89-Vol.1, pp. 111-120) **Changes of precipitation in Finland.** Heino, R. (Finnish Meteorological Inst., Helsinki (Finland)). Academy of Finland, Helsinki (Finland). 1989. (CONF-8909491–Vol.1: Conference on climate and water, Helsinki (Finland), 11-15 Sep 1989). In *Conference on climate and water: Volume 1.* 520p. Order Number DE93721620. Source: OSTI; NTIS.

A review on long-term changes of precipitation in Finland is presented. The homogeneity of the precipitation records is also discussed. Changes of precipitation gauges as well as relocations of stations and other environmental changes explain much of the long-term changes of precipitation. Taking into account the main sources of inhomogeneity some general features of precipitation changes can be shown. They include: a long-term decrease in southern Finland and a recent increase in the middle parts of the country, while in the north the changes have been small.

1511 (SA-PUB–9/89-Vol.1, pp. 149-157) **Atmospheric transport of heat and water: A review.** Holopainen, E.O. (Helsinki Univ. (Finland). Dept. of Meteorology). Academy of Finland, Helsinki (Finland). 1989. (CONF-8909491–Vol.1: Conference on climate and water, Helsinki (Finland), 11-15 Sep 1989). In *Conference on climate and water: Volume 1.* 520p. Order Number DE93721620. Source: OSTI; NTIS.

The paper reviews recent studies of atmospheric cycles of water and energy based on the use of atmospheric circulation data. Applications of the 'aerological method' of determining the difference between surface evaporation and precipitation, as well as those of the 'residual method' of inferring the distribution of diabatic heating in the atmosphere are considered. It appears that recent developments in meteorological data assimilation methods have considerably improved the usefulness of these methods. The validation of the estimates of total atmospheric energy source against satellite measurements of net radiation is also discussed.

1512 (SA-PUB–9/89-Vol.1, pp. 177-186) **The characterization of hydrometeorological elements.** Winter, J. (Technical University Budapest (Hungary). Dept. of Water Supply Management). Academy of Finland, Helsinki (Finland). 1989. (CONF-8909491–Vol.1: Conference on climate and water, Helsinki (Finland), 11-15 Sep 1989). In *Conference on climate and water: Volume 1.* 520p. Order Number DE93721620. Source: OSTI; NTIS.

In Hungary studies and written data do not support the warming trend and lack of precipitation found in the climate of the world in general. As a significant trend cannot been found within the climate of Northern-Hungary, the closer study of hydrometeorological element statistics are well-founded. The characterization was made using the monthly mean value, that is to say, the amount of temperature, sunshine duration, air humidity, the amount of wind and precipitation.

1513 (SA-PUB–9/89-Vol.1, pp. 197-208) **The long term evolution of the Italian climate outlined by using the standardized anomaly index (SAI).** Giuffrida, A. (Servizio Meteorologico dell Aeronautica, Roma (Italy)); Conte, M. Academy of Finland, Helsinki (Finland). 1989. (CONF-8909491–Vol.1: Conference on climate and water, Helsinki (Finland), 11-15 Sep 1989). In *Conference on climate and water: Volume 1.* 520p. Order Number DE93721620. Source: OSTI; NTIS.

Climatic change studies are very interesting, but present difficulties connected to the need of long lasting and homogenous data sets. In the study the SAI is applied to groups of Italian stations for which data of temperature are available since 1866 and data of rainfall since 1813. The application is made to annual values. In the field of temperature, a clear and significative trend is shown. The SAI values pass from -0,30 to +0,19, that is, extending the Sharon Nicholson's subdivision, from below the normal to positive normal values. In the field of precipitation, a smoothing of the SAI of the whole set of data shows a 'parabolic' shape indicating an increase of rainfall in the first half of the set and a decrease starting, approximately, since 1900. The decrease is in particular marked in these last 30 years.

1514 (SA-PUB–9/89-Vol.1, pp. 209-218) **Changing synoptic weather patterns, rainfall regimes and acid inputs in the East Midlands, U.K.** Wilby, R. (Loughborough Univ. of Technology (GB). Geography Dept.). Academy of Finland, Helsinki (Finland). 1989. (CONF-8909491–Vol.1: Conference on climate and water, Helsinki (Finland), 11-15 Sep 1989). In *Conference on climate and water: Volume 1.* 520p. Order Number DE93721620. Source: OSTI; NTIS.

A significance of synoptic variations over time-scales of 10-100 years for inputs of acidic ions to catchment hydrochemical systems is investigated. A methodology is presented for the use of the Lamb's Weather Type register to both reconstruct and to predict future rainfall amounts and acidities. A number of tentative predictions are made for the East Midlands, U.K. on the basis of recent and contemporary synoptic trends.

1515 (SA-PUB–9/89-Vol.1, pp. 300-318) **Snow and ice - nonrenewable natural resources in the future.** Kuusisto, E. (National Board of Waters and the Environment, Helsinki (Finland)). Academy of Finland, Helsinki (Finland). 1989. (CONF-8909491–Vol.1: Conference on climate and water, Helsinki (Finland), 11-15 Sep 1989). In *Conference on climate and water: Volume 1.* 520p. Order Number DE93721620. Source: OSTI; NTIS.

The Earth's climate will change in the next decades - possibly at a rate seldom exceeded in the past. The group of hydrological variables most sensitive to climatic changes will be the cryospheric ones, i.e. those related to snow and ice. Their relationship to the climatic system is discussed.

1516 (SA-PUB–9/89-Vol.1, pp. 319-328) **Influence of glacierisation on the response of runoff from Alpine basins to climate variability.** Collins, D.N. (Univ. of Manchester (GB). Alpine Glacier Project). Academy of Finland, Helsinki (Finland). 1989. (CONF-8909491–Vol.1: Conference on climate and water, Helsinki (Finland), 11-15 Sep 1989). In *Conference on climate and water: Volume 1.* 520p. Order Number DE93721620. Source: OSTI; NTIS.

Records of runoff from gauges on rivers draining basins of between 1.9 and 66,6 % glacier-cover in the Rhone catchment, Switzerland have been examined together with records of air temperature and precipitation in the period 191O-1987. Precipitation was more variable from year to year than thermal input. At higher levels of glacierisation, energy input dominates runoff variability, but at low levels precipitation variation is the main influence. Considerable variations in discharge from highly-glacierised basins have resulted from underlying secular variations in energy inputs.

1517 (SA-PUB–9/89-Vol.1, pp. 329-338) **150 years since C.G. Haellstoem's studies on ice break-up dates as climatic indicators.** Kajander, J.M. (Water and Environment Research Institute, Helsinki (Finland)). Academy of Finland, Helsinki (Finland). 1989. (CONF-8909491–Vol.1: Conference on climate and water, Helsinki (Finland), 11-15 Sep 1989). In *Conference on climate and water: Volume 1.* 520p. Order Number DE93721620. Source: OSTI; NTIS.

In 1839, a lecture on using the ice break-up dates as indicators of climatic change was given in the monthly session of the Finnish Society of Sciences by Gustaf Gabriel Haellstroem. In the three research reports by him, the problem is for the first time approached by applying regression analysis. This method is still relevant and now much easier to use. The results of Haellstroem are discussed and a similar analysis is made for the much more extensive 20th century Finnish material. The results show some significant local warming trends but no common pattern.

1518 (SA-PUB–9/89-Vol.1, pp. 339-352) **Simulation of the effects of climate changes on a glacier in Western Norway.** Laumann, T. (Norwegian Water Resources and Energy Administration, Oslo (Norway)); Tvede, A.M. Academy of Finland, Helsinki (Finland). 1989. (CONF-8909491–Vol.1: Conference on climate and water, Helsinki (Finland), 11-15 Sep 1989). In *Conference on climate and water: Volume 1.* 520p. Order Number DE93721620. Source: OSTI; NTIS.

The paper presents a model system used to simulate the effects from climate changes on a glacier named Graabreen at the Folgefonni ice cap in Western Norway. One part of the system calculates the annual net balance of the glacier from input of air temperature and precipitation data from Bergen, the other part simulates the physical conditions of the ice-masses and the advance or retreat of the glacier front. Four scenarios of climate changes are tested, two of which give as result an advancing glacier after year 2002, while the two others gave a retreating glacier. The simulations show that the glacier is sensitive to changes in the precipitation pattern in the fall.

1519 (SA-PUB–9/89-Vol.1, pp. 365-391) **Effects of climate variability and change on fresh water bodies.** Liebscher, H. (Bundesanstalt fuer Gewuesserkunde, Koblenz (Germany, F.R.)). Academy of Finland, Helsinki (Finland). 1989. (CONF-8909491–Vol.1: Conference on climate and water, Helsinki (Finland), 11-15 Sep 1989). In *Conference on climate and water: Volume 1.* 520p. Order Number DE93721620. Source: OSTI; NTIS.

An overview of the possible impacts of climatic changes on surface waters and on the planning of water-resources systems is presented. The most important current international programmes for investigating these impacts are described. Necessary research and other related activities for filling gaps of knowledge are pointed out.

1520 (SA-PUB–9/89-Vol.1, pp. 426-436) **Estimating the impacts of climatic change on river flows; some examples from Britain.** Arnell, N. (Institute of Hydrology, Wallingford (GB)); Reynard, N. Academy of Finland, Helsinki (Finland). 1989. (CONF-8909491–Vol.1: Conference on climate and water, Helsinki (Finland), 11-15 Sep 1989). In *Conference on climate and water: Volume 1.* 520p. Order Number DE93721620. Source: OSTI; NTIS.

Future climatic changes may have a very significant effect on water resource availability, and the results from studies of possible impacts will facilitate efficient resource management. The sensitivities of average annual runoff in Britain to changes in annual precipitation and evaporation have been examined using a regional relationship, and it has been shown that changes in runoff are much more sensitive to changes in precipitation. The greatest sensitivity is found in the drier south east. A simple regression model was used to generate time series of monthly flows under current and perturbed climates at several sites in Britain. Flow seasonality was shown to increase in a warmer, wetter world, and flows in groundwater catchments may be sustained during drier summers by greater winter and spring rainfall totals.

1521 (SA-PUB–9/89-Vol.1, pp. 437-449) **Climate-induced effects on the water balance: Preliminary results from studies in the Vaerpinge experimental research basin.** Berndtsson, R. (Lund Univ. (Sweden). Dept. of Water Resources Engineering); Larson, M.; Lindh, G.; Malm, J.; Niemczynowicz, J.; Zhang, T. Academy of Finland, Helsinki (Finland). 1989. (CONF-8909491–Vol.1: Conference on climate and water, Helsinki (Finland), 11-15 Sep 1989). In *Conference on climate and water: Volume 1.* 520p. Order Number DE93721620. Source: OSTI; NTIS.

The present study focuses upon the effects of anthropogenic-induced climatic change on monthly water balances. Observed monthly water balances during ten years and different future climatic scenarios were used to calculate the effects on runoff and soil moisture storage. It is shown that an annual precipitation increase of 20 % and an overall annual increase in temperature of 2 deg C results in a more than 50 % increase in annual runoff. It is also shown that an increased precipitation is balanced by an increased evapotranspiration not affecting the summer soil water

storage. However, a decrease in precipitation combined with a temperature increase will considerably effect the soil water storage and hence the availability of plant water. Further and more detailed studies are outlined.

1522 (SA-PUB–9/89-Vol.1, pp. 450-461) **Long-term trends in river flow in Finland.** Hyvaerinen, V. (Water and Environment Research Institute, Helsinki (Finland). Hydrological Office); Leppaejaervi, R. Academy of Finland, Helsinki (Finland). 1989. (CONF-8909491–Vol.1: Conference on climate and water, Helsinki (Finland), 11-15 Sep 1989). In *Conference on climate and water: Volume 1.* 520p. Order Number DE93721620. Source: OSTI; NTIS.

A selection of long-term Finnish discharge observation series has been analyzed. Annual discharges have generally increased slightly in most of Finland and especially in the 1980s, but it is too early to decide if this is due to climatic change or to climatic fluctuations. Winter discharges have increased by as much as 20 per cent in some Finnish lakes during the 20th century. This trend is in line with results of climate models, which suggest that both precipitation and temperature are increasing as a result of atmospheric greenhouse effect, especially at northern latitudes in winter.

1523 (SA-PUB–9/89-Vol.1, pp. 462-475) **Water balance investigations in Swiss Alpine basins - tool for the improved understanding of impacts of climatic chance on water resources.** Schaedler, B. (Swiss National Hydrological and Geological Survey, Bern (Switzerland)). Academy of Finland, Helsinki (Finland). 1989. (CONF-8909491–Vol.1: Conference on climate and water, Helsinki (Finland), 11-15 Sep 1989). In *Conference on climate and water: Volume 1.* 520p. Order Number DE93721620. Source: OSTI; NTIS.

Runoff-data series of 70 to 90 years for 9 small- to medium-size research basins in different regions of Switzerland are discussed. The different altitude and geology of these basins result in specific hydrological response, depending on the climatic variation in this century. For the River Rhine data series of the water balance components for 450 years are estimated from climatological proxy-data and compared with reconstructed runoff-data from water level observations and with precipitation measurements. Within that time, the recent period seems to be the warmest and wettest one. Therefore, there is no other period which could give any indications for the changes of water resources with future potential CO_2-induced climate change.

1524 (SA-PUB–9/89-Vol.1, pp. 476-485) **Gradual climate change and resulting hydrologic response.** Singh, K.P. (Illinois State Water Survey, Champaign (US)); Ramamurthy, G.S. Academy of Finland, Helsinki (Finland). 1989. (CONF-8909491–Vol.1: Conference on climate and water, Helsinki (Finland), 11-15 Sep 1989). In *Conference on climate and water: Volume 1.* 520p. Order Number DE93721620. Source: OSTI; NTIS.

For the last 20 years the northern part of the state of Illinois has been experiencing a wetter and cooler climate than in the past. This climate change has increased river flows and flood peaks, resulting in increased streambed and bank erosion, higher groundwater levels in levee-protected farmlands, and decreased freeboard for the levees. The climate changes considered over 20- to 40-year periods and associated changes in hydrology require careful consideration in design and development of water resources to meet the design purposes, even through the periods of climate changes.

1525 (SA-PUB–9/89-Vol.1, pp. 486-500) **The effect of climate variability and change on groundwater in Europe.** Thomsen, R. (Aarhus Amtskommune, Hoejbjerg (Denmark). Miljoekontoret). Academy of Finland, Helsinki (Finland). 1989. (CONF-8909491–Vol.1: Conference on climate and water, Helsinki (Finland), 11-15 Sep 1989). In *Conference on climate and water: Volume 1.* 520p. Order Number DE93721620. Source: OSTI; NTIS.

In Europe groundwater is the most important freshwater resource for public water supply and industry. Analysis of European rainfall show that rainfall variates with time. Research in Denmark shows that groundwater responds to climatic variation. The paper show that southwest Scandinavia, western and northeast France as well as Belgium can expect a decrease in groundwater recharge. In some parts of Europe this decrease will have catastrophic effects for the local water industry. Water resource planning and future monitoring of the water balance and water quality must be based on hydrological models and the use of long timeseries. Basic research on climatic change is thus of great and immediate practical importance for economic development in Europe.

1526 (SA-PUB–9/89-Vol.1, pp. 511-520) **Impact of climate change on groundwater recharge.** Sharma, M.L. (Commenwealth Scientific and Industrial Resources Organization, Wembley (Australia). Division of Water Resources). Academy of Finland, Helsinki (Finland). 1989. (CONF-8909491–Vol.1: Conference on climate and water, Helsinki (Finland), 11-15 Sep 1989). In *Conference on climate and water: Volume 1.* 520p. Order Number DE93721620. Source: OSTI; NTIS.

A mechanistic model, considering soil-plant-atmosphere interactions, was applied to simulate recharge rates beneath an annual grassland, and a perennial pine plantation, growing on sandy soil profiles representative of the Swan Coastal Plain of Western Australia. The sensitivity of the recharge (R) predicted by the model to changes in rainfall (P) was evaluated for a period of twelve months using measured daily rainfall and its variation. Simulations showed that recharge was modified by a much larger proportion than rainfall, and this was greatly influenced by land use. For example a 20 % change in P modified R by +- 30 % beneath the grassland and by +- 120 % beneath the pine plantation. The depth of rooting in relation to the water table had a significant effect on such modifications. Implications of possible modifications in recharge due to the greenhouse effect are explored in relation to the groundwater resources of an important sandy aquifer.

1527 (SA-PUB–9/89-Vol.2) **Conference on climate and water: Volume 2.** Huttunen, L. (ed.). Academy of Finland, Helsinki (Finland). 1989. 393p. (CONF-8909491–Vol.2: Conference on climate and water, Helsinki (Finland), 11-15 Sep 1989). Order Number DE93721621. Source: OSTI; NTIS.

This book contains the Proceedings of the Conference on Climate and Water under the following groupings: Impacts of climatic variability and change-resulting from the changes in hydrological variables; Aquatic environment; Terrestrial environment; Coastal zones and navigation; Urban and industrial water supply and drainage; Energy production; Intropogenic changes of climate and water management problems; Flood potential; Irrigation and land drainage.

1528 (SA-PUB–9/89-Vol.2, pp. 79-88) **A complex model for environmental qualifying.** Koris, K. (Budapest University for Technology, Budapest (Hungary). Dept. for Water Resources Management). Academy of Finland, Helsinki (Finland). 1989. (CONF-8909491–Vol.2: Conference on climate and water, Helsinki (Finland), 11-15 Sep 1989). In *Conference on climate and water: Volume 2.* 393p. Order Number DE93721621. Source: OSTI; NTIS.

A quantitative characterization of the environmental situation is an important information whenever a judgment of the environment's quality is formed or investments are planned or decisions are to be supported. Such a quantitative qualification of the environment may play an important role even on a regional - e.g., European - scale, when forming an opinion on the quality of the given region's environment or preparing regional strategies for environment protection or signing pacts for regional protection of the environment. The model and numerical example, to be shown in this paper, describe the environment of a minor region by a parameter system of water, air, and soil quality. It is a task of the future to include ecological /biological/and social /economical/components into the model. In such a way, the model is an approximative measure of the environment's state, comparing the latter with similarly computed quality categories, i.e., classifying the given state. If any of the quality parameters changes /e.g., the NO_x emission of a country is reduced/, the environment's quality changes as well and the numerical value of this change can be expressed by the model. It may even be possible, after a suitable modification of the model, to characterize quantitatively regional climate changes.

1529 (SA-PUB–9/89-Vol.2, pp. 290-309) **Environmental impact on climate due to man made reservoirs.** Rossi, G.

(National Electricity Board of Italy, Venezia (Italy). Studies and Research Dept.). Academy of Finland, Helsinki (Finland). 1989. (CONF-8909491–Vol.2: Conference on climate and water, Helsinki (Finland), 11-15 Sep 1989). In *Conference on climate and water: Volume 2.* 393p. Order Number DE93721621. Source: OSTI; NTIS.

The impact on the environment due to the building and the management of a hydroelectric reservoir covers many aspects ranging from human and social to hydrologic, agricultural and climatic ones. The overall parameters that may represent both the climatic regime and the vegetation fitness are evaporation and evapotranspiration; they are the keystones of the feedback processes involving the lower atmosphere layer, solar energy fluxes, heat and water exchanges, surface and subsurface fluxes and transpiration strength. The method adopted to calculate evapotranspiration, usually on a monthly scale, is derived from the complementary relationship by F.I. Morton which relates regional and potential evapotranspiration (Eta and Etp) with regional evapotranspiration in saturated conditions (Etv), through an index depending on the water availability. By this procedure it is possible to make-up climatic indexes involving both evapotranspiration and evaporation. The problem of the evaluation of the environmental impact may be approached by two strategies depending on climatological data availability: Historical series if climatological data has been recorded over a long period before the reservoir is put into operation; Witness basin when climatological data are available only after the reservoir has started operating, gathering data both from the basin under control and from a witness basin, in the neighbourhood of the former but not influenced by the reservoir, presumed to have the same regional evapotranspiration. The impact on the environment may be evaluated analysing the trend of such indexes before and after the reservoir operation, following the first strategy, and by the comparison of the two sets of the indexes calculated for the same period, following the second strategy.

1530 (SA-PUB–9/89-Vol.2, pp. 310-347) **Anthropogenic changes or climate, water resources and water management problems.** Shiklomanor, I.A. (State Hydrological Institute, Leningrad (USSR)). Academy of Finland, Helsinki (Finland). 1989. (CONF-8909491–Vol.2: Conference on climate and water, Helsinki (Finland), 11-15 Sep 1989). In *Conference on climate and water: Volume 2.* 393p. Order Number DE93721621. Source: OSTI; NTIS.

The importance of the problem is shown on the study of the hydrological cycle in the conditions of the anthropogenic changes of the global climate resulted from higher concentrations of 'greenhouse' gases in the atmosphere. Methodological approaches are considered as well as basic data and prerequisites used by different scientists to evaluate and predict the effect of climatic changes on water resources and on hydrological regime. The results obtained for different physiographic regions of the world are given and analyzed, including the latest data on the forecasts of river runoff changes for the USSR territory by the end of the present century. General considerations on the effect of the expected climatic changes on water supply, control and water transfers are presented. The results of computations of the future water level in the Caspian Sea are given with the account of possible anthropogenic changes of the global climate.

1531 (SA-PUB–9/89-Vol.2, pp. 348-356) **Flood potential, an uncertain estimate resulting from climatic variability and change.** Nobilis, F. (Hydrographisches Zentralbuero, Vienna (Austria)). Academy of Finland, Helsinki (Finland). 1989. (CONF-8909491–Vol.2: Conference on climate and water, Helsinki (Finland), 11-15 Sep 1989). In *Conference on climate and water: Volume 2.* 393p. Order Number DE93721621. Source: OSTI; NTIS.

The paper tries to give hints for future flood potential respectively its change in connection with climate variability and change. As a matter of fact there are only few quantitative results, moreover the present model properties are not apt to give regionally limited information. It will be necessary to intensify the efforts in research because of the potential danger for man and the financial effect.

1532 (SA-PUB–9/89-Vol.2, pp. 357-371) **Impact of climate variability and change on water resource management in agriculture.** Nemec, J. (Swiss Federal Institute of Technology, Zuerich (Switzerland). Dept. of Geography). Academy of Finland, Helsinki (Finland). 1989. (CONF-8909491–Vol.2: Conference on climate and water, Helsinki (Finland), 11-15 Sep 1989). In *Conference on climate and water: Volume 2.* 393p. Order Number DE93721621. Source: OSTI; NTIS.

The impact on water resources management is considered in the framework of general impact on agricultural land production and the need of its increase due to population growth by the end of this and beginning of next century. Some methodologies to assess this latter impact are described. It is furthermore considered that water resources management in agriculture is presenting a second aspect as a subset of impact of climate change on water resources. Since the water needs of crops are managed mainly by irrigation and to a lesser extent by drainage, the present situation of this management is reviewed and projections of needs are proposed. Concrete methodologies for assessment of climate change impact on the irrigation management are described and a proposal is made for assessment of impact by use of agroecological zoning and related food production potential.

1533 (SA-PUB–9/89-Vol.2, pp. 372-382) **An assessment of climatic changes impacts on water resources management in an irrigated zone.** Pryazhinskaya, V.G. (USSR Academic of Sciences, Moscow (USSR) Water Problems Institute). Academy of Finland, Helsinki (Finland). 1989. (CONF-8909491–Vol.2: Conference on climate and water, Helsinki (Finland), 11-15 Sep 1989). In *Conference on climate and water: Volume 2.* 393p. Order Number DE93721621. Source: OSTI; NTIS.

The methodology for an assessment of climatic changes impacts on water resources management on a regional scale is based on the application of forecasting models. Regional and global climatic changes impacts are simulated with regard to the internal links in the natural-social-economic system. An application of optimization and simulation models to the evaluation of various production allocation alternatives under changing climatic scenarios with regard to some environmental impacts of agriculture is discussed.

1534 (SNV–4045) **The greenhouse gases: Emissions and countermeasures in an international perspective.** Swedish Environmental Protection Agency, Solna (Sweden). Dec 1991. 150p. Order Number DE93721674. Source: OSTI; NTIS.

Also availabe in Swedish as SNV-4011.

This report to the Swedish government aims at describing the factual basis of the greenhouse gas problem. Methods to account for the greenhouse gas emissions are treated, including the possibility to smooth out randomized yearly fluctuations in air temperature and precipitation. The 1990 emission of greenhouse gases are illustrated and forecasting has been done to AD 2000. (22 figs.).

1535 (UCRL-JC–111820) **Aerosol transport and global models.** Penner, J.E. Lawrence Livermore National Lab., CA (United States). Sep 1992. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9209246–1: National Aeronautics and Space Administration (NASA) workshop on global aerosols and biogeochemistry, Orlando, FL (United States), 1-3 Sep 1992). Order Number DE93001618. Source: OSTI; NTIS; GPO Dep.

Recently, attention has been focused mainly on the effects of anthropogenic aerosols on climate. Anthropogenic aerosols may cool the climate by direct reflection of solar radiation and by their effect on clouds. This report discusses the effects of several components on global models, and discusses the transport of these aerosols.

1536 (WSRC-MS–92-211) **Performing wind-tunnel modeling for better management of near-field risks.** Huang, Ju-Chrong; Weber, A.H. Westinghouse Savannah River Co., Aiken, SC (United States). [1992]. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. (CONF-9208117–12: 1992 Energy Facility Contractors Group (EFCOG) safety anaiysis workshop, Salt Lake City, UT (United States), 11-13 Aug 1992). Order Number DE92040205. Source: OSTI; NTIS; INIS; GPO Dep.

All industrial complexes must be able to demonstrate that air pollutant concentrations from normal and accidental releases are within the bounds of stringent acceptance criteria. The offsite concentrations are comparatively easy to compute with the standard Gaussian models. By contrast, the onsite (in particular, near-field) concentrations can be more complex since the wind flows can interact with various structures in complex ways to create regions of relatively high local concentrations. Three methods can be used to predict the air pollutant concentrations: (1) mathematical models, (2) field experiments, and (3) fluid models (wind-tunnel testing). The complex flow in the vicinity of buildings is not amenable to simple mathematical generalizations. Field experiments cannot encompass the wind spectrum of meteorological conditions in the time generally allotted. Wind tunnel testing works best where numerical models fail and field testing is not applicable. This paper covers the following aspects related to the wind-tunnel modeling studies: (1) planning strategies; (2) types of wind-tunnel modeling studies flow visualization and concentration measurement experiments; (3) highlights (video tape show) of the wind tunnel experiments; (4) technical challenges; and (5) various applications.

1537 (Y/ENG/SE–109) **Atmospheric transport analysis used in hazard screening methodology.** Bloom, S.G. Oak Ridge Y-12 Plant, TN (United States). 29 Jun 1992. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OS21400. (CONF-921110–28: Winter annual meeting of the American Society of Mechanical Engineers (ASME), Anaheim, CA (United States), 8-13 Nov 1992). Order Number DE92041267. Source: OSTI; NTIS; GPO Dep.

Simple, but conservative, atmospheric transport models are used in the initial stages of a hazard screening methodology to determine a preliminary hazard rank. The hazard rank is one indicator of the additional effort, if any, that must be applied to determine if a system is safe. Simple methods avoid prolonged calculations at this early stage when details of potential accidents may be poorly defined. The models are used to simulate the consequences resulting from accidental releases of toxic substances. Instantaneous and constant-rate releases are considered. If a release takes place within a relatively small enclosure, the close-in transport is approximated by assuming the airborne material is instantaneously mixed with the volume of air within this enclosure. For all other situations and large distances, the transport is estimated with simple atmospheric dispersion models using published values of dispersion coefficients for large distances, and values based on turbulent diffusion theory for close-in distances. Consequences are assessed by defining exposure levels that are equivalent to negligible, reversible, and irreversible health effects. The hazard rank is related to the number and location of people within each category of health effects.

1538 (YMP-BOOKL–15/1989) **Air quality management in Finland.** Ministry of the Environment, Helsinki (Finland). Environmental Protection Dept. 1989. 31p. Order Number DE93711146. Source: OSTI; NTIS.

In 1985, the Finnish Ministry of the Environment published a booklet entitled 'Air Quality Management in Finland'. Since then, air pollution control has developed rapidly and new information is required. It has proved necessary to compile a revised booklet of air pollution control in Finland, to include the measures that have been taken domestically and internationally significant decisions on air pollution control. In this booklet, the main emphasis is upon reporting on emissions, steps that have been taken to limit emissions, and results obtained in reducing them. There is no detailed information on air quality in urban areas in this booklet, a deficiency which, naturally, limits the overall picture. An air quality management data base currently being developed will correct this deficiency in future publications.

1539 (YMP-BROCH–39/1991) **Adification research in Finland: Review of the results of the Finnish adification research programme (HAPRO) 1985-1990.** Kenttaemies, K. Ministry of the Environment, Helsinki (Finland). Environmental Protection Dept. 1991. 48p. Order Number DE93711149. Source: OSTI; NTIS.

Storing of birch wholetree chips was studied on the south west side of Lokka reservoir, in Sodankylae at latitude 68 degrees north. The purpose of the study was to examine the effects of storing time, cover and underbase on pile temperature, wood moisture, dry matter losses and heat value. Two 3000 m^2 loose piles were made to carry out the study. The dry matter losses were found to increase with time. Chips under plastic cover were found to suffer greater losses than those without cover. The use of cover also increased wood moisture content. When using plastic underbase the long storage periods seem to cause some of the moisture to collect on the bottom part of the pile. Hence it follows that the use of plastic as a cover and underbase material can not be justified. On one hand the increase in moisture content caused by the treatment and increased storage time and on the other hand the mixing of mineral soil with fuel chips had a negative effect on the heating value.

1540 (YMP-D–34/1987) **Intercalibration of sulfur dioxide monitors: Intercalibration of monitors.** Walden, J.; Laettilae, H.; Hyppoenen, M.; Plathan, P.; Virtanen, T. Ministry of the Environment, Helsinki (Finland). Environmental Protection Dept. 1987. 105p. (In Finnish). Order Number DE93711134. Source: OSTI; NTIS.

These tests showed that although the monitors are continuously functioning, they need to be kept under surveillance; the maintenance schedules should be followed regularly according to the manuals. The length of these tests was not sufficient to give statisfactory information about the operational reliability. During the test period, however, there were no very significant malfunctionings in the operation of the monitors.

1541 (YMP-D–49/1988) **Level of dioxin emissions and measurement techniques in Finland: A literature review.** Tirkkonen, T. (Technical Research Centre of Finland, Espoo (Finland). Chemical Lab.); Laukkarinen, A. Ministry of the Environment, Helsinki (Finland). Environmental Protection Dept. 1988. 67p. (In Finnish). Order Number DE93711138. Source: OSTI; NTIS.

This report includes preliminary estimates concerning dioxin emissions from a limited number of sources in Finland. The estimates are based on domestic measurements as well as on estimates and measurements done in other countries, especially in Sweden and Germany. In Finland different institutions are developing sampling and analysis methods for dioxins.

1542 (YMP-D–55/1988) **Second workshop on integrated monitoring (WIM 2): Workshop report.** Sisula, H.; Soederman, G. (eds.). Ministry of the Environment, Helsinki (Finland). Environmental Protection Dept. 1988. 84p. (CONF-8810561–: WIM 2: 2. workshop on integrated monitoring, Espoo (Finland), 5-8 Oct 1988). Order Number DE93711064. Source: OSTI; NTIS.

The Second Workshop on Integrated Monitoring was held in Espoo, Hanasaari, Finland, 5-8 October 1988. The meeting was attended by participants from fourteen countries and five international organizations. The workshop report contains the unianomously at the closing session adopted Workshop Statement, the list of participants, the programme, the reports of the eight working groups and the opening address as well as the papers given at the plenary sessions. The more detailed results of the workshop are presented in the draft versions of the Methodology Manual produced by the Finnish Environmental Data Centre by the end of 1988.

1543 (YMP-R–64/1989) **The release of cadmium and mercury into the Finnish environment.** Mukherjee, A. (Univ. of Helsinki (Finland). Dept. of Environmental Conservation). Ministry of the Environment, Helsinki (Finland). Environmental Protection Dept. 1989. 93p. Order Number DE93711143. Source: OSTI; NTIS.

The study concerns emissions of cadmium and mercury from industries in Finland. In 1987 the estimated cadmium emissions into air amounted to 3.22 tons, and into water to 1.00 tons. Cadmium emissions into the soil amounted to 147 tons. A comparison of these figures with information from the early 1980s shows diminishing emissions into air and water. In spite of this fact the amount of pollution from the main sources, the metal industry and power plants using fossile fuels, is still relatively high. The increase in total mercury emissions into the environment are due to the high mercury contents of raw materials used in the metal industry and in the power plants, the high mercury contents of batteries and jarosite wastes, and lacking capacity in industry to prevent the escape of mercury fumes and particles from processes.

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Refer also to citation(s) 130, 225, 227, 228, 234, 235, 238, 248, 250, 252, 267, 281, 287, 288, 289, 290, 291, 292, 293, 294, 296, 297, 611, 733, 767, 888, 892, 1525, 1526, 1528, 1539, 1542, 1543, 1631, 1649, 1650, 1651, 1663, 1675, 1726, 2430, 2434, 2435, 2442, 2443

1544 (AECL–10003) **Analysis of diffusive mass transport in a cracked buffer.** Garisto, N.C.; Garisto, F. Atomic Energy of Canada Ltd., Pinawa, MB (Canada). Whiteshell Nuclear Research Establishment. Nov 1989. 57p. Order Number DE93603554. Source: OSTI; NTIS (US Sales Only); INIS.

In the disposal vault design for the Canadian Nuclear Fuel Waste Management Program, cylindrical containers of used nuclear fuel would be placed in vertical boreholes in rock and surrounded with a bentonite-based buffer material. The buffer is expected to absorb and/or retard radionuclides leaching from the fuel after the containers fail. There is some evidence, however, that the buffer may be susceptible to cracking. In this report we investigate numerically the consequences of cracking on uranium diffusion through the buffer. The derivation of the mass-transport equations and the numerical solution method are presented for the solubility-limited diffusion of uranium in a cracked buffer system for both swept-away and semi-impermeable boundary conditions at the rock-buffer interface. The results indicate that for swept-away boundary conditions the total uranium flux through the cracked buffer system is, as expected, greater than through the uncracked buffer. The effect of the cracks is strongly dependent on the ratio D/D_{eff}, where D and D_{eff} are the pore-water and the effective buffer diffusion coefficient, respectively. However, although a decrease in D_{eff} enhances the effect of cracks on the total cumulative flux (relative to the uncracked buffer), it also decreases the total cumulative flux through the cracked buffer system (relative to a cracked buffer with a larger D_{eff} value). Finally, for semi-impermeable boundary conditions, the effect of cracks on the total radionuclide flux is relatively small.

1545 (AECL–10068) **MCDIRC: A model to estimate creep produced by microcracking around a shaft in intact rock.** Wilkins, B.J.S.; Rigby, G.L. Atomic Energy of Canada Ltd., Pinawa, MB (Canada). Whiteshell Nuclear Research Establishment. Dec 1989. 30p. Order Number DE93605431. Source: OSTI; NTIS (US Sales Only); INIS.

Atomic Energy of Canada Limited (AECL) is studying the concept of disposing of nuclear fuel waste in a vault in plutonic rock. Models are being developed to predict the mechanical behaviour of the rock in response to excavation and heat from the waste. The dominant mechanism of deformation at temperatures below 150 degrees C is microcracking, which results in rock creep and a decrease in rock strength. A model has been constructed to consider the perturbation of the stress state of intact rock by a vertical cylindrical opening. Slow crack-growth data are used to estimate time-dependent changes in rock strength, from which the movement (creep) of the opening wall and radial strain in the rock mass can be estimated.

1546 (AECL–10169) **In situ stress determination by the overcoring of large surface strain gauge rosettes on the walls of a raise-bored shaft at the Underground Research Laboratory.** Chandler, N.A. Atomic Energy of Canada Ltd., Pinawa, MB (Canada). Whiteshell Nuclear Research Establishment. Aug 1991. 56p. Order Number DE93603571. Source: OSTI; NTIS (US Sales Only); INIS.

AECL Research is conducting a series of experiments to examine the influence of scale on measured in situ stresses in granite rock. The ventilation raise rosette overcoring experiment is one such test. This experiment, modelled on a previous test conducted in Australia, consisted of overcoring four 120-mm strain gauge rosettes glued to the surface of a 1.8-m-diameter bored raise. The in situ stresses were calculated from the measured strains using the equations for stresses around a cylindrical excavation in an elastic material. The possibility of excavation disturbance around the ventilation raise was investigated using overcore stress measurements, elastic modulus tests on retrieved core, and visual inspection of thin sections obtained from removed core. The effect of a stress-dependent elastic modulus (referred to as non-linear elastic behaviour) is also addressed. Results from the ventilation raise rosette overcoring experiment suggest that rosette overcoring in a bored raise is an acceptable stress-measurement method. The effects of scale and excavation damage on the stress measurements were not considered to be significant; however, if the elastic modulus of the rock is strongly stress-dependent, non-linear elastic behaviour may have a small effect on the measured stresses.

1547 (AECL–10182) **The link between performance assessment and quality of data.** Csullog, G.W. Atomic Energy of Canada Ltd., Chalk River, ON (Canada). Chalk River Nuclear Labs. Nov 1990. 16p. (CONF-9005332–: 2. International Seminar on Radioactive Waste Products, Juelich (Germany), 28 May - 1 jun 1990). Order Number DE93603555. Source: OSTI; NTIS (US Sales Only); INIS.

Performance assessments, using both individual and cumulative inventories, produce estimates of the risk or dose consequences for repository concepts. Unacceptable risk or dose for a given contaminant identify it as a problem contaminant. While risk or dose consequences are common outputs of safety assessments, results can also be reported as estimates of the safe inventory limit for each contaminant in a repository scenario. Once problem contaminants are identified, it may be useful to: validate the data used in the performance assessment; restrict contaminant inventories in the repository; or, improve the containment capability of the repository (including improved packaging). A key point is that performance assessments define the quality of data to be collected. If a contaminant's inventory will be far below its estimated safe inventory limit for a repository, then it is reasonable to accept inventory estimates that have high variances and low confidence. For contaminants that have a significant impact upon performance assessments, efforts must be made to provide the best inventory (source term) estimates practicable. One important goal of characterization programs should be to establish the adequacy of data used in performance assessments. There is little value in striving to improve confidence in data for some waste streams if they are assessed to have a minor impact upon repository performance. Streams that have a major impact upon performance deserve the time, attention and money to be characterized adequately. Waste acceptance must be linked to the quality of characterization data provided by generators. This link sets compliance monitoring requirements.

1548 (AECL–10277) **A radionuclide mass-transport model for the performance assessment of engineered barriers in a used nuclear fuel disposal vault.** Garisto, N.C.; LeNeveu, D.M. Atomic Energy of Canada Ltd., Pinawa, MB (Canada). Whiteshell Nuclear Research Establishment. Aug 1991. 60p. Order Number DE93603556. Source: OSTI; NTIS (US Sales Only); INIS.

The Vault Model has been developed to assess the performance of engineered barriers in a conceptual disposal vault for used nuclear fuel. The disposal concept being assessed is that of a sealed vault mined at a depth of 500 to 1000 m in plutonic rock in the Canadian Shield. In this report, we describe the conceptual and mathematical framework of the radionuclide mass-transport model used in the Vault Model and discuss the assumptions used in its derivation. The model represents the mass transport of radionuclides released from used-fuel containers, through clay-based sealing materials and into the surrounding rock. It uses one-dimensional diffusion-convection equations for radionuclide transport in a decay chain of arbitrary length, in finite media. The equations are solved semi-analytically using Laplace transform techniques.

1549 (ANL/CP–76923) **Criteria for evaluating the health risk remaining after bioremediation of a buried mass of diesel fuel No. 2.** Rosenblatt, D.H.; Montemagno, C.D. Argonne National Lab., IL (United States). [1992]. 30p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9209216–1: 7. national conference on hydrocarbon contaminated soils, Amherst, MA (United States), 21-24 Sep 1992). Order Number DE92040745. Source: OSTI; NTIS; GPO Dep.

In February 1975, 59,000 gal of diesel fuel No. 2 were accidentally released from a storage tank at Sandia National Laboratories (SNL), Livermore, California, a Department of Energy facility. Over succeeding years, the fuel migrated downward. The present study was intended (1) to delineate the current threat to groundwater

quality and (2) to provide a means to evaluate the potential effect on groundwater of a presumed hydrocarbon residue after bioremediation. The release resulted from the accidental puncture of an underground transfer line buried 4 ft below the surface; a small amount of fuel oil was recovered from a 2-ft-deep light pole trench near the puncture. Most of the spill traveled laterally and downward, reaching the unconfined aquifer, which subsequently receded. The oil plume lies mainly at a depth of 10–100 ft, within a 30- to 100-ft radius of the spill point. None of the fuel contaminated the soil surface; hence, the only significant future exposure would be expected to occur through drinking water from a hypothetical well just downgradient of the spill site and drilled into the uppermost water-bearing zone. Such a well is possible but is unlikely because of the very low groundwater yield and poor water quality.

1550 (ANL/RP–76697) **Technical action plan at former Commodity Credit Corporation grain storage sites in Nebraska and Kansas.** Argonne National Lab., IL (United States). Jan 1992. 13p. Sponsored by Department of Agriculture, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE92040715. Source: OSTI; NTIS; GPO Dep.

This document has been prepared for the Commodity Credit Corporation of the US Department of Agriculture (CCC/USDA) to provide an outline for a multiyear plan for technical investigations at sites in Kansas and Nebraska that have been identified as having groundwater contamination. Carbon tetrachloride is the primary contaminant of concern at sites in Nebraska and Kansas where former CCC/USDA grain storage facilities were located.

1551 (CONF-9106396–1) **Global climate change: Some implications, opportunities, and challenges for US forestry.** Marland, G. Oak Ridge National Lab., TN (United States). [1991]. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 21. Southern forest tree improvement conference (SFTIC); Knoxville, TN (United States); 17-20 Jun 1991. Order Number DE92040874. Source: OSTI; NTIS; INIS; GPO Dep.

It is widely agreed that the concentration of greenhouse gases in the earth's atmosphere is increasing, that this increase is a consequence of man's activities, and that there is significant risk that this will lead to changes in the earth's climate. The question is now being discussed what, if anything, we should be doing to minimize and/or adapt to changes in climate. Virtually every statement on this matter; from the US Office of Technology Assessment, to the National Academy of Science, to the Nairobi Declaration on Climatic Change, includes some recommendation for planting and protecting forests. In fact, forestry is intimately involved in the climate change debate for several reasons: changing climate patterns will affect existing forests, tropical deforestation is one of the major sources of greenhouse gases to the atmosphere, reforestation projects could remove additional carbon dioxide from the atmosphere and there is renewed interest in wood-based or other renewable fuels to replace fossil fuels. Part of the enthusiasm for forestry-related strategies in a greenhouse context is the perception that forests not only provide greenhouse benefits but also serve other desirable social objectives. This discussion will explore the current range of thinking in this area and try to stimulate additional thinking on the rationality of the forestry-based approaches and the challenges posed for US forestry.

1552 (CONF-921207–1) **Environmental emissions from biomass energy feedstocks.** Perlack, R.D.; Ranney, J.W.; Wright, L.L. Oak Ridge National Lab., TN (United States). [1992]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From American Society of Agricultural Engineers alternate energy conference; Nashville, TN (United States); 14-15 Dec 1992. Order Number DE92040029. Source: OSTI; NTIS; INIS; GPO Dep.

Study results indicate the total emissions from energy crop production, harvesting, and transport are relatively small. CO_2 emissions are an order of magnitude lower than those for liquid petroleum fuels. The environmental impacts from agricultural chemical use and erosion are also small. However, their exact level depends greatly on the type of land and the crops displaced.

1553 (DOE/BP/07096–2) **System-wide significance of predation on juvenile salmonids in the Columbia and Snake River reservoirs: Annual report of research 1991.** Shively, R.S.; Tabor, R.A.; Nelle, R.D.; Jepsen, D.B.; Petersen, J.H.; Sauter, S.T.; Poe, T.P. Fish and Wildlife Service, Portland, OR (United States). Columbia River Field Station. 1991. 56p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AI79-90BP07096. Order Number DE92040931. Source: OSTI; NTIS; GPO Dep.

We indexed consumption rates of northern squawfish (Ptychoch oregonensis) preying upon juvenile salmonids in four lower Snake River reservoirs. Stomach contents were also collected from smallmouth bass (Micropterus dolomieui), channel catfish (Ictaluris gunctatus), and walleye (Stizostedion vitreum). Northern squawfish digestive tracts were analyzed and the overall diet (% weight) was dominated by fish and crustaceans. Examination of stomach contents smallmouth bass showed that crustaceans (primarily crayfish) dominated their diets. Overall, the consumption rate of juvenile salmonids by smallmouth bass was low. The northern squawfish consumption index (CI) at Snake River locations ranged from zero at all mid-reservoir locations to 1.2 at Lower Granite forebay. In John Day Reservoir, CI values ranged from 0.5 to 1.9 in May and from 0.9 to 3.0 in July. Consumption index values were highest in forebay and tailrace areas, and were slightly higher in BRZs than in non-restricted zones.

1554 (DOE/EH–0283) **Tiger Team Assessment of the Navel Petroleum and Oil Shale Reserves Colorado, Utah, and Wyoming.** USDOE Assistant Secretary for Environment, Safety, and Health, Washington, DC (United States). Jul 1992. 592p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93002602. Source: OSTI; NTIS; GPO Dep.

This report documents the Tiger Team Assessment of the Naval Petroleum Oil Shale Reserves in Colorado, Utah, and Wyoming (NPOSR-CUW). NPOSR-CUW consists of Naval Petroleum Reserve Number 3 located near Casper, Wyoming; Naval Oil Shale Reserve Number I and Naval Oil Shale Reserve Number 3 located near Rifle, Colorado; and Naval Oil Shale Reserve Number 2 located near Vernal, Utah, which was not examined as part of this assessment. The assessment was comprehensive, encompassing environment, safety, and health (ES&H) and quality assurance (QA) disciplines; site remediation; facilities management; and waste management operations. Compliance with applicable Federal, state, and local regulations; applicable DOE Orders; best management practices; and internal NPOSR-CUW requirements was assessed. The NPOSR-CUW Tiger Team Assessment is part of a larger, comprehensive DOE Tiger Team Independent Assessment Program planned for DOE facilities. The objective of the initiative is to provide the Secretary with information on the compliance status of DOE facilities with regard to ES&H requirements, root causes for noncompliance, adequacy of DOE and contractor ES&H management programs, response actions to address the identified problem areas, and DOE-wide ES&H compliance trends and root causes.

1555 (DOE/ER–0390) **Selection of subsoils, saturated zone materials, and related sorbents for subsurface research: Rationale for selection of experimental materials for DOE research in subsoils and in groundwater: Subsurface Science Program.** Ainsworth, C.C.; Zachara, J.M. In collaboration with Dr. Frank J. Wobber. Pacific Northwest Lab., Richland, WA (United States). [1988]. 31p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE92040275. Source: OSTI; NTIS; GPO Dep.

This report describes reference subsoils and aquifer materials that support research in DOE's Subsurface Science Program. Research is being conducted on the geochemical behavior of co-contaminants in the subsurface, for example: (1) the mechanisms of organic contaminant sorption to mineral surfaces; (2) the rates and mechanisms of microbiological degradation of organic contaminants; (3) the flow physics of organic liquids in saturated and unsaturated porous media; (4) the identity and chemical reactivity of colloids in groundwater; and, (5) the physical and chemical nature of absorbed water on mineral surfaces and its role in contaminant binding to sorbent surfaces. Sorption and degradation experiments are performed at the laboratory and intermediate scale using a reference collection of subsurface materials and single

phase components (e.g., clays, oxides, humic substances) which are described herein. This report describes how and why these particular materials were selected as research substrates; the report summarizes the properties of the reference materials as they relate to the vadose and saturated zones and how these materials are being used to understand organic contaminant reactions in the subsurface. The primary set of reference materials is being augmented with (1) samples of opportunity from deeper vadose and saturated zones, and (2) with pure phase organic and mineral solids for fundamental studies of contaminant sorption and degradation mechanisms.

1556 (DOE/ER/60245–T1) **Research on the seasonal snow of the Arctic Slope: Annual progress report, July 15, 1984–January 15, 1986.** Benson, C.S. Alaska Univ., Fairbanks, AK (United States). Geophysical Inst. [1986]. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG06-84ER60245. Order Number DE93001748. Source: OSTI; NTIS; GPO Dep.

This project deals with the seasonal snow on Alaska's Arctic Slope. It is concentrated on snow of the R_4D project area. However, an important aspect of this study is to relate the snow cover of this area with the rest of the Arctic Slope. The goals include determination of the amount of precipitation which comes as snow, the wind transport of this snow and its depositional pattern as influenced by drifting, the physical properties of the snow, the physical processes which operate in it, the proportions of it which go into evaporation, infiltration and runoff, and the biological role of the snow cover.

1557 (DOE/ER/60247–T3) **Active layer hydrology for Imnavait Creek, Toolik, Alaska: Annual progress report, July 1984–January 1986.** Kane, D.L. Alaska Univ., Fairbanks, AK (United States). Water Research Center. [1986]. 47p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG06-84ER60247. Order Number DE93001747. Source: OSTI; NTIS; GPO Dep.

In the annual hydrologic cycle, snowmelt is the most significant event at Imnavait Creek located near Toolik Lake, Alaska. Precipitation that has accumulated for more than 6 months on the surface melts in a relatively short period of 7 to 10 days once sustained melting occurs. During the ablation period, runoff dominates the hydrologic cycle. Some meltwater goes to rewetting the organic soils in the active layer. The remainder is lost primarily because of evaporation, since transpiration is not a very active process at this time. Following the snowmelt period, evapotranspiration becomes the dominate process, with base flow contributing the other watershed losses. It is important to note that the water initally lost by evapotranspiration entered the organic layer during melt. This water from the snowpack ensures that each year the various plant communities will have sufficient water to start a new summer of growth.

1558 (DOE/ER/60253–T5) **Rangeland – Plant responses to elevated CO_2: Progress report.** Owensby, C.E.; Coyne, P.I.; Ham, J.M.; Parton, W.; Rice, C.; Auen, L.M.; Adam, N. Kansas State Univ., Manhattan, KS (United States). Dept. of Agronomy. 1992. 129p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-84ER60253. Order Number DE93000883. Source: OSTI; NTIS; GPO Dep.

Several broad conclusions which can be drawn from the work that was accomplished during the first 3-year phase of the study is described. In prairie ecosystems dominated by C_4 grasses, it is likely that elevated atmospheric CO_2 will increase ecosystem level productivity, with a greater increase in belowground productivity. The increased productivity will primarily result from increased water use efficiency due to the anti-transpirant action of CO_2. Fumigation chambers are directly confounded with elevated CO_2 effects, in that both reduce evapotranspiration. The reduced evapotranspiration of the fumigation chamber is primarily through reduced wind speeds and reduced radiation. In very dry years, fumigation chamber effects are negligible, but in years with normal precipitation, chamber effects and elevated CO_2 effects are essentially equal with respect to reduced evapotranspiration effects. Increased production under elevated CO_2 results in reduced nitrogen concentration in the herbage and increased fiber concentrations. Consequently, digestibility of the herbage is reduced, and microbial degradation of surface litter and soil organic matter is slowed. On the negative side, ruminant productivity will likely be reduced substantially, but increased carbon storage in the soil may buffer against future rise in atmospheric CO_2. Tallgrass prairie will not likely change greatly in botanical composition, since the C_4 dominants responded to elevated CO_2 more than the C_3 subdominants.

1559 (DOE/ER/60612–4) **Nitrogen availability as a control mechanism of secondary succession within a semiarid shrubland ecosystem: Final report, October 1, 1990–June 27, 1992.** Redente, E.F.; McLendon, T. Colorado State Univ., Fort Collins, CO (United States). Dept. of Range Science. 25 Sep 1992. 70p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-87ER60612. Order Number DE93000384. Source: OSTI; NTIS; GPO Dep.

Three experiments were conducted within a semiarid shrubland to test the role of nitrogen availability as a control mechanism in secondary succession. Secondary succession patterns were documented for seven years and effects of increased and decreased N availability levels, fumigation, and competition by early-seral species were tested. Differential responses by seral species were determined and related to successional patterns. Nitrogen availability was found to be a primary mechanism controlling the rate of succession. Relative growth rate was an important factor determining which species initially dominated and N availability became the primary control factor by the third year. As N availability increased, the rate of succession decreased. Conversely, as N availability was decreased, the rate of succession increased. The abundance of annuals was increased and abundance of perennials decreased by increased N availability. Tissue N concentration was related to lifeform and seral position, and these relationships were important in the transition from early- to mid-seral stages. Decomposer subsystem dynamics were correlated with seral community dynamics. The effect of fumigation was minimized by initially planting with late-seral species. A conceptual model of secondary succession is presented based on N availability, relative growth rate, lifeform, and decomposition dynamics.

1560 (DOE/ER/60715–3) **Spatial scaling: its analysis and effects on animal movements in semiarid landscape mosaics: Final report, 1 September 1988–31 May 1992.** Wiens, J.A. Colorado State Univ., Fort Collins, CO (United States). Dept. of Biology. Sep 1992. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-88ER60715. Order Number DE93000896. Source: OSTI; NTIS; GPO Dep.

The research conducted under this agreement focused in general on the effects of envirorunental heterogeneity on movements of animals and materials in semiarid grassland landscapes, on the form of scale-dependency of ecological patterns and processes, and on approaches to extrapolating among spatial scales. The findings are summarized in a series of published and unpublished papers that are included as the main body of this report. We demonstrated the value of "experimental model systems" employing observations and experiments conducted in small-scale microlandscapes to test concepts relating to flows of individuals and materials through complex, heterogeneous mosaics. We used fractal analysis extensively in this research, and showed how fractal measures can produce insights and lead,to questions that do not emerge from more traditional scale-dependent measures. We developed new concepts and theory to deal with scale-dependency in ecological systems and with integrating individual movement patterns into considerations of population and ecosystem dynamics.

1561 (DOE/ER/60842–T1) **Factors affecting transport of bacterial cells in porous media: Technical progress report.** Mills, A.L.; Herman, J.S.; Hornberger, G.M. Virginia Univ., Charlottesville, VA (United States). Dept. of Environmental Sciences. Jul 1992. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-89ER60842. Order Number DE93001848. Source: OSTI; NTIS; GPO Dep.

This study focused on identification of factors associated with the biology, chemistry, and hydrology of the subsurface environment that control bacterial transport through that habitat. We determined that control is a complex interaction of biological factors such as cell size and hydrophobicity, geochemical factors such as ionic

strength of the ground water, and hydrological factors including the presence of preferred flow paths in the porous medium.

1562 (DOE/ER/61159–2) **Physiological and phylogenetic study of microbes from geochemically and hydrogeologically diverse subsurface environments: Interim technical report, November 1, 1991–September 30, 1992.** Balkwill, D.L.; Reeves, R.H. Florida State Univ., Tallahassee, FL (United States). Dept. of Biological Science. 1 Oct 1992. 70p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-91ER61159 ;FG05-90ER61039. Order Number DE93001846. Source: OSTI; NTIS; GPO Dep.

An important aspect of our ongoing research effort in the DOE Deep Microbiology Program has been the characterization of certain microorganisms in samples of subsurface materials from various DOE production sites. Recently, it was our responsibility to determine the numbers, diversity, morphological characteristics, and physiological traits (including the potential metabolic capabilities) of the viable, aerobic, chemoheterotrophic micro-organisms in samples that were obtained from the Idaho National Engineering Laboratory (INEL) and the Hanford Reservation (HR) in 1990. It was decided that the physiological characteristics of the INEL and HR subsurface microbial isolates would be analyzed during the current project. We describe here the research on physiological characteristics that has been completed during the eleven-month period covered by the present technical report. Approximately 750 microbial strains were isolated by our laboratory from the INEL and HR samples in 1990 and 1991. During the portion of the current project covered by this interim report, all of these strains were tested for their ability to utilize each of 95 different organic compounds as sole sources of carbon. Identifications are based on how well the carbon utilization patterns of the isolates match those of 659 species and subspecies (i.e., established taxa).

1563 (ECN-C–91-066) **Isothermal behaviour of a Gloetzl in the HAW test field.** Benneker, P.B.J.M.; Hamilton, L.F.M. Netherlands Energy Research Foundation (ECN), Petten (Netherlands). May 1991. 23p. Contract nr. F1-1W-0003-D(B). Order Number DE93603572. Source: OSTI; NTIS; INIS.

This work has been performed in the framework of the Commission of the European Communities R and D Programme on Management and Storage of Radioactive Waste.

The HAW test field in the Asse mine (Germany) is a one-to-one scale test facility of an underground repository. One objective of the HAW project is to measure thermally induced stresses and deformation fields in the surrounding rock. Many measuring instruments have been placed in specially drilled holes at various locations to measure pressure change in the test field. One of the types used is the so-called 'Gloetzl' pressure cell. The measuring result of a 'Gloetzl' is a combination of pressure build-up as result of local borehole deformation due to creep and stress changes due to changes in the global field around the measuring borehole. Especially in the isothermal and low temperature situation results are dominated by this local borehole deformation. To understand the measuring results of a 'Gloetzl' better an analysis had been performed in which time-dependent (isothermal) behaviour of the measuring hole is investigated using a finite element program. Delay between borehole drilling and final emplacement of the device into the borehole is varied. From the results it can be obtained that the time between drilling of the hole and 'Gloetzl'-emplacement influences the pressure result for a very long period of time and the recuperation to the boundary stresses needs more than 300 years. Thus, the measuring results of the 'Gloetzls' can not be considered to represent directly the stresses in the field. The behaviour under heated conditions needs more detailed analyses. (author). 2 refs.; 9 figs.

1564 (EMO–1028-Vol.8) **[Environmental investigation of ground water contamination at Wright-Patterson Air Force Base, Ohio]: Volume 8, Focused feasibility study.** Pacific Northwest Lab., Richland, WA (United States). Environmental Management Operations; IT Corp., Cincinnati, OH (United States). Mar 1992. 203p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE92040804. Source: OSTI; NTIS; INIS; GPO Dep.

The Phase I, Task 5, Focused Feasibility Study (FFS) has been prepared as part of the Environmental Investigation of Ground Water Contamination Project being conducted by Wright-Patterson Air Force Base (WPAFB). The primary objective of this FFS was to select a cost-effective method of preventing migration of contaminated ground water across the southwestern boundary of Area C of the Base. The FFS presented in this document is a portion of a much larger effort being conducted at WPAFB. The detailed analysis of alternatives for the extraction, treatment, and discharge of contaminated ground water migrating across the southwest boundary of Area C at WPAFB led to the selection of a preferred removal action alternative. Specifically, this alternative is that ground water be extracted utilizing a three well array pumping at a total of 400 to 800 gpm, removed water be treated via air stripping to achieve appropriate effluent concentrations, and treated water be discharged to the Mad River in accordance with a National Pollution Discharge Elimination System (NPDES) permit and other relevant permits.

1565 (EMO–1028-Vol.9) **[Environmental investigation of ground water contamination at Wright-Patterson Air Force Base, Ohio]: Volume 9, Removal action system design.** Pacific Northwest Lab., Richland, WA (United States). Environmental Management Operations; IT Corp., Cincinnati, OH (United States). Apr 1992. 205p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE92040805. Source: OSTI; NTIS; INIS; GPO Dep.

This Removal Action System Design has been prepared as a Phase I Volume for the implementation of the Phase II removal action at Wright-Patterson Air Force Base (WPAFB) near Dayton, Ohio. The objective of the removal action is to prevent, to the extent practicable, the migration of ground water contaminated with chlorinated volatile organic compounds (VOCS) across the southwest boundary of Area C. The Phase 1, Volume 9 Removal Action System Design compiles the design documents prepared for the Phase II Removal Action. These documents, which are presented in Appendices to Volume 9, include: Process Design, which presents the 30 percent design for the ground water treatment system (GWTS); Design Packages 1 and 2 for Earthwork and Road Construction, and the Discharge Pipeline, respectively; no drawings are included in the appendix; Design Package 3 for installation of the Ground Water Extraction Well(s); Design Package 4 for installation of the Monitoring Well Instrumentation; and Design Package 5 for installation of the Ground Water Treatment System; this Design Package is incorporated by reference because of its size.

1566 (IC–92/192) **Two-dimensional transport of dust from an infinite line source at ground level: non-zero roughness height.** Hassan, M.H.A. (International Centre for Theoretical Physics, Trieste (Italy)); Eltayeb, I.A. International Centre for Theoretical Physics, Trieste (Italy). Jul 1992. 10p. Order Number DE93605433. Source: OSTI; NTIS (US Sales Only); INIS.

The previous study (Eltayeb and Hassan, 1992) of the two-dimensional diffusion equation of dust over a rough ground surface, which acts as a dust source of variable strength, under the influence of horizontal wind and gravitational attraction is here extended to all finite values of the roughness height Z_0. An analytic expression is obtained for the concentration of dust for a general strength of the source. The result reduces to the previously known solutions as special cases. The expression for the concentration has been evaluated for some representative example of the source strength g(X). It is found that the concentration decreases with roughness height at any fixed point above ground level. (author). 4 refs, 2 figs.

1567 (INFO–0378) **Earthquake-Induced liquefaction in Ferland, Quebec.** Tuttle, M. (Multi-Agency Group for Neotectonics in Eastern Canada (Canada)); Seeber, L. Atomic Energy Control Board, Ottawa, ON (Canada). Feb 1991. 59p. (MAGNEC-C–91-01.). Order Number DE93603573. Source: OSTI; NTIS (US Sales Only); INIS.

Detailed geological investigations are under way at a number of liquefaction sites in the Ferland-Boilleau valley, Quebec, where sand boils, ground cracks and liquefaction-related damages to homes were documented immediately following the Ms=6.0, Mblg=6.5 Saguenay earthquake of November 25, 1988. To date, results obtained from these subsurface investigations of sand boils

at two sites in Ferland, located about 26 km from the epicentre, indicate that: the Saguenay earthquake induced liquefaction in late-Pleistocene and Holocene sediments which was recorded as sand dikes, sills and vents in near-surface sediments and soils; earthquake-induced liquefaction and ground failure have occurred in this area at least three times in the past 10,000 years; and, the size and morphology of liquefaction features and the liquefaction susceptibility of source layers of the features may be indicative of the intensity of ground shaking. These preliminary results are very promising and suggest that with continued research liquefaction features will become a useful tool in glaciated terrains, such as northeastern North America, for determining not only the timing and location but also the size of past earthquakes.

1568 (INFO–0411) **Aqueous uranium concentrations in the natural environment.** Anderson, M.T. (Environmental and Technological Research Associates Ltd., (Canada)). Atomic Energy Control Board, Ottawa, ON (Canada). Apr 1992. 110p. Order Number DE93603557. Source: OSTI; NTIS (US Sales Only); INIS.

Published geochemical data from groundwater and surface water throughout the world has been compiled in order to compare the concentration of naturally occurring dissolved uranium to lithology, sampling depth, pH, Eh, HCO_3, SO_4 and PO_4 concentrations. The sole criterion used for the selection of data from the review articles was that each article contain raw data on naturally occurring uranium concentrations relative to other groundwater chemical components. A total of 1286 chemical data entries were used in the statistical comparisons. Although this database is not exhaustive, it is likely that the ranges of uranium concentrations in the data set are representative of the ranges occurring in nature. Finally, the observed uranium concentration distributions were compared with published results of model calculations and of used nuclear fuel leach tests. Models tend to predict a wider range of concentrations than observed (particularly the high values), and the leach test concentrations tend to fall within the upper half of the observations.

1569 (INIS-BR–2940) **Brazil Geological Basic Survey Program: special project of mineral resources, soils and vegetation maps for the region of Grande Carajas Program - Mineral resources sub project - Serra dos Carajas - Sheet SB.22-Z-A - Para State.** Araujo, O.J.B. de; Maia, R.G.N. Departamento Nacional de Producao Mineral (DNPM), Brasilia, DF (Brazil); Companhia de Pesquisas de Recursos Minerais (CPRM), Rio de Janeiro, RJ (Brazil). 1991 162p. (In Portuguese). Order Number DE93603543. Source: OSTI; NTIS (US Sales Only); INIS.

The geologic landscape at Serra dos Carajas Sheet encloses portions of Southern Para granite-greenstone terrain, Itacaiunas and Araguaia Belts as well as Proterozoic litho-structural components. It shows medium magnetic relief and low radiometric levels due to meta mafic-ultramafic sequences and the high Na granitoids intrusions. The Proterozoic components are represented by a series of anorogenic granitic intrusions shown by distinctive aero gamaspectrometric anomalies. The well known metallogenetic characteristics includes gold, iron, manganese, nickel and aluminium mines and/or deposits and several mineral occurrences mainly chromium, tin, copper, and zinc. (author).

1570 (INIS-BR–2941) **Brazil Geological Basic Survey Program - Espera River - Sheet SF.23-X-B-IV - Minas Gerais State.** Raposo, F.O. Departamento Nacional de Producao Mineral (DNPM), Brasilia, DF (Brazil); Companhia de Pesquisas de Recursos Minerais (CPRM), Belo Horizonte, MG (Brazil). Superintendencia Regional de Belo Horizonte. 1991 196p. (In Portuguese). Order Number DE93603544. Source: OSTI; NTIS (US Sales Only); INIS.

The present report refers to the Rio Espera sheet (SF.23.X-B-IV) systematic geological mapping, on the 1:100.000 scale. The sheet, which covers Zona da Mata region, includes the Southeastern bord of Minas Gerais Metallurgic Zone, SE of Quadrilatero Ferrifero, in the Sao Francisco craton bord, and Mantiqueira province. Since only one doubtful 2,5 thousand million year - Rb/Sr isochron was obtained in the sheet, Archacan and Proterozoic ages have been attributed to the metamorphic rocks by comparison to other ones elsewhere. An analysis of the crustal evolution pattern based on gravimetric survey data, aeromagnetometry and available geochronological data is given in the 6. Chapter, Part II of the text. Major elements oxides and rare-earths were analysed to establish parameters for the rocks environment elucidation. The geochemical survey was carried out with base on pan concentrated and stream sediments distributed throughout the sheet. (author).

1571 (KAERI/RR–1042/91) **Study on radioactivation analysis.** Chung, Yong Sam (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Cho, Seung Yeon; Chung, Young Ju. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Jan 1992. 67p. Order Number DE93605426. Source: OSTI; NTIS (US Sales Only); INIS.

Thermal and epithermal neutron activation analysis followed by high resolution gamma-ray spectrometry, is applied to determine trace elements in the silicate rocks. Epithermal neutron irradiations reduce interfering activities such as ^{38}Cl,^{66}Cu,^{56}Mn,^{24}Na,^{46}Sc, etc. The effect is represented as the advantage factors for various elements. The concentrations of 40 elements with the detection limits are determined under the analytical condition. The precision and accuracy of the method are compared with the results of USGS standard's rock, G-2 and AGV-1 analyses. (Author).

1572 (LA–12206) **Atlas of the breeding birds of Los Alamos County, New Mexico.** Travis, J.R. (Pajarito Ornithological Survey, NM (United States)). Los Alamos National Lab., NM (United States); Pajarito Ornithological Survey, NM (United States). Oct 1992. 291p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE93002118. Source: OSTI; NTIS; GPO Dep.

This atlas shows the geographic distribution of breeding birds within the county of Los Alamos, New Mexico, based on field surveys from 1984 through 1988. The county was divided into 60 square blocks, each 2.5 kilometers on a side. We attempted to confirm breeding of all the bird species in every block. The atlas maps show the distribution of the 112 species found. Breeding dates and other information on breeding behavior are provided, and species distribution patterns and species-habitat relationships in the county are presented.

1573 (LA–12335-MS) **The Cambric migration experiment: A summary report.** Bryant, E.A. Los Alamos National Lab., NM (United States). Sep 1992. 37p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE92040619. Source: OSTI; NTIS; INIS; GPO Dep.

The Cambric migration experiment was undertaken in 1974 to provide data concerning the migration of radionuclides away from the site of a nuclear test where there is an induced hydraulic gradient. First, the distribution of radioactive isotopes around the site of the Cambric explosion was investigated by analysis of samples recovered from a hole drilled through the nuclear debris. Then water was pumped from a well, located 91 m away, to induce flow from the nuclear explosion site. Analyses of water samples showed that the migration velocity of tritium, ^{16}Cl, ^{85}Kr, ^{99}Tc, ^{106}Ru, and ^{129}I was nearly the same as that of the moving water, from the explosion site to the pumped well. Less than 0.5% of the total ^{90}Sr and 0.0003% of the total ^{137}Cs accompanied the tritium to the pumped well, although both isotopes appear to have migrated away from the source zone to some extent. The concentration of ^{239}Pu at the pumped well was below the detection limit of 10^6 atoms/mℓ in water collected at the time of peak tritium concentration. Peak tritium concentration in the pumped water occurred when 5,000,000 m^3 had been pumped

1574 (ORNL–6638) **Results of the radiological survey at the Sacandaga site Glenville, New York: Waste Management Research and Development Programs.** Foley, R.D.; Cottrell, W.D.; Carrier, R.F. Oak Ridge National Lab., TN (United States). Aug 1992. 73p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93000503. Source: OSTI; NTIS; INIS; GPO Dep.

The Sacandaga site, located on Sacandaga Road, Glenville, New York, was operated by the General Electric Company for the Atomic Energy Commission (AEC) between 1947 and 1951. Originally used for the study and development of radar during World War II, the facilities housed later operations involving physics studies and sodium technology development in support of breeder reactor design and other AEC programs. Though not in use since

the original equipment was dismantled and removed in the early 1950s, portions of the 51-acre site are known to contain buried rubble from demolished structures used in former operations. At the request of the Office of Naval Reactors through the Office of Remedial Action and Waste Technology, a characterization of current radiological conditions over the site was performed between August and October 1989. The survey included the measurement of direct radiation levels (gamma, alpha, and beta-gamma) over all surfaces both inside and outside the building and tunnel, radionuclide analysis of systematic, biased, and auger hole soil samples, and analysis of sediments from underground structures. Gamma logging of auger holes was conducted and removable contamination levels inside the tunnel were determined. Samples of soil and structural materials from within and around an excavated concrete bunker were analyzed to determine concentrations of radionuclides and nonradioactive elemental beryllium.

1575 (ORNL/ER–90) **Model of the PCB and mercury exposure of mink and great blue heron inhabiting the off-site environment downstream from the US Department of Energy Oak Ridge Reservation: Environmental Restoration Program.** MacIntosh, D.L. (Indiana Univ., Bloomington, IN (United States). School of Public and Environmental Affairs); Suter, G.W. II; Hoffman, F.O. Oak Ridge National Lab., TN (United States). Sep 1992. 65p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93001297. Source: OSTI; NTIS; INIS; GPO Dep.

Environmental Sciences Division Publication 3934.

This report presents a pair of wildlife exposure models developed for use in investigating the risks to wildlife of releases of mercury and PCBS. The species modeled are the great blue heron and mink The models may be used to estimate the exposure experienced by mink and herons, to help establish remedial action goals and to identify research needs. Because mercury and PCBs bioaccumulate through dietary uptake, the models simulate the food webs supporting the two species. Sources of contaminants include surface water, sediment, sediment pore water, and soil. The model are stochastic equilibrium models. Two types of variance in the input parameters are distinguished: stochastic variance among individual mink and herons and ignorance concerning true parameter values. The variance in the output due to stochastic parameters indicates the expected variance among the receptors. The variance due to ignorance indicates the extent to which the model outputs could be unpaved by additional sampling and measurement. The results of the models were compared to concentrations measured in great blue heron eggs and nestlings from colonies on the Clinch and Tennessee Rivers. The predicted concentrations agreed well with the measured concentrations. In addition, the variances in measured values among individuals was approximately equal to the total stochastic variance predicted by the models.

1576 (ORNL/RASA–91/19) **Radiological survey results at 13 Cliff Street, Beverly, Massachusetts (VB015).** Foley, R.D.; Johnson, C.A. Oak Ridge National Lab., TN (United States). Jul 1992. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92041368. Source: OSTI; NTIS; INIS; GPO Dep.

At the request of the US Department of Energy (DOE), a team from Oak Ridge National Laboratory conducted a radiological survey at 13 Cliff Street, Beverly, Massachusetts. The survey was performed in May 1991. The purpose of the survey was to determine if uranium from work performed under government contract at the former Ventron facility had migrated off-site to neighboring areas. The survey included a surface gamma scan, a beta-gamma scan of paved areas, and the collection of soil samples for radionuclide analyses. Results of the survey demonstrated no radionuclide concentrations or radiation measurements in excess of the DOE Formerly Utilized Sites Remedial Action Program guidelines.

1577 (ORNL/RASA–91/22) **Radiological survey results at 2 Porter Street, Beverly, Massachusetts (VB005).** Foley, R.D.; Carrier, R.F. Oak Ridge National Lab., TN (United States). Aug 1992. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93000556. Source: OSTI; NTIS; INIS; GPO Dep.

At the request of the US Department of Energy (DOE), a team from Oak Ridge National Laboratory conducted a radiological survey at 2 Porter Street, Beverly, Massachusetts. The survey was performed in May 1991. The purpose of the survey was to determine if uranium dust from work performed under government contract at the former Ventron facility had migrated off-site to neighboring areas. The survey included a surface gamma scan and the collection of soil samples fore radionuclide analyses. Results of the survey demonstrated no radionuclide concentrations or radiation measurements in excess of the DOE Formerly Utilized Sites Remedial Action Program guidelines.

1578 (ORNL/RASA–91/25) **Radiological survey results at 14 Cliff Street, Beverly, Massachusetts (VB011).** Foley, R.D.; Carrier, R.F. Oak Ridge National Lab., TN (United States). Aug 1992. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93000550. Source: OSTI; NTIS; INIS; GPO Dep.

At the request of the US Department of Energy (DOE), a team from Oak Ridge National Laboratory conducted a radiological survey at 14 Cliff Street, Beverly, Massachusetts. The survey was performed in May 1991. The purpose of the survey was to determine if uranium dust from work performed under government contract at the former Ventron facility had migrated off-site to neighboring areas. The survey included a surface gamma scan and the collection of soil samples for radionuclide analyses. Results of the survey demonstrated no radionuclide concentrations or radiation measurements in excess of the DOE Formerly Utilized Sites Remedial Action Program guidelines.

1579 (ORNL/RASA–91/26) **Radiological survey results at 18 Cliff Street, Beverly, Massachusetts (VB012).** Foley, R.D.; Carrier, R.F. Oak Ridge National Lab., TN (United States). Aug 1992. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93000555. Source: OSTI; NTIS; INIS; GPO Dep.

At the request of the US Department of Energy (DOE), a team from Oak Ridge National Laboratory conducted a radiological survey at 18 Cliff Street, Beverly, Massachusetts. The survey was performed in May 1991. The purpose of the survey was to determine if uranium dust from work performed under government contract at the former Ventron facility had migrated off-site to neighboring areas. The survey included a surface gamma scan and the collection of soil samples for radionuclide analyses. Results of the survey demonstrated no radionuclide concentrations or radiation measurements in excess of the DOE mannerly Utilized Sites Remedial Action Program guidelines.

1580 (ORNL/RASA–91/27) **Radiological survey results at 20 Cliff Street, Beverly, Massachusetts (VB013).** Foley, R.D.; Carrier, R.F. Oak Ridge National Lab., TN (United States). Aug 1992. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93000552. Source: OSTI; NTIS; INIS; GPO Dep.

At the request of the US Department of Energy (DOE), a team from Oak Ridge National Laboratory conducted a radiological survey at 20 Cliff Street, Beverly, Massachusetts. The survey was performed in May 1991. The purpose of the survey was to determine if uranium dust from work performed under government contract at the former Ventron facility had migrated off-site to neighboring areas. The survey included a surface gamma scan and the collection of soil samples for radionuclide analyses. Results of the survey demonstrated no radionuclide concentrations or radiation measurements in excess of the DOE Formerly Utilized Sites Remedial Action Program guidelines.

1581 (ORNL/RASA–92/3) **Radiological survey results at 8 Cliff Street, Beverly, Massachusetts (VB009).** Foley, R.D.; Carrier, R.F. Oak Ridge National Lab., TN (United States). Aug 1992. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93000551. Source: OSTI; NTIS; INIS; GPO Dep.

At the request of the US Department of Energy (DOE), a team from Oak Ridge National Laboratory conducted a radiological survey at 8 Cliff Street, Beverly, Massachusetts. The survey was

performed in May 1991. The purpose of the survey was to determine if uranium dust from work performed under government contract at the former Ventron facility had migrated off-site to neighboring areas. The survey included a surface gamma scan and the collection of soil samples for radionuclide analyses. Results of the survey demonstrated no radionuclide concentrations or radiation measurements in excess of the DOE Formerly Utilized Sites Remedial Action Program guidelines.

1582 (PNL–8143) **Fiscal year 1991 report on archaeological surveys of the 100 Areas, Hanford Site, Washington.** Chatters, J.C.; Gard, H.A.; Minthorn, P.E. Pacific Northwest Lab., Richland, WA (United States). Sep 1992. 27p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93001344. Source: OSTI; NTIS; INIS; GPO Dep.

In compliance with Section 106 of the National Historic Preservation Act (NHPA), and at the request of Westinghouse Hanford Company, the Hanford Cultured Resources Laboratory (HCRL) conducted an archaeological survey during FY 1991 of the 100-Area reactor compounds on the US Department of Energy's Hanford Site. This survey was conducted as part of a comprehensive resources review of 100-Area Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) operable units in support of CERCLA characterization activities. The work included a lite and records review and pedestrian survey of the project area following procedures set forth in the Hanford Cultural Resources Management Plan.

1583 (SA-PUB–9/89-Vol.1, pp. 167-176) **Determination of areal evapotranspiration from satellite data using a temperature/surface fluxes inversion model.** Sucksdorff, Y. (National Board of Waters and the Environment, Helsinki (Finland)); Ottle, C. Academy of Finland, Helsinki (Finland). 1989. (CONF-8909491–Vol.1: Conference on climate and water, Helsinki (Finland), 11-15 Sep 1989). In *Conference on climate and water: Volume 1.* 520p. Order Number DE93721620. Source: OSTI; NTIS.

A method for calculating areal evaporation by using synoptical weather data and satellite imaginery is presented. Many studies have shown that over vegetated areas, if the atmospheric and surface parameters are known, the energetic and hydraulic budgets at the surface can be modelised. Then the surface temperature estimated from satellite thermal IR-measurements permits to retrieve surface evaporation by inversion of the model /3,2,12/. This method, which has been developed at C.R.P.E., has been applied at a large scale in southern Finland. Landsat TM images and digitized map data are used for calculating the land-use parameters. The normalized difference vegetation index (NDVI) is calculated from NOAA-AVHRR images. To estimate the surface temperature from AVHRR channel 4 images the data have to be corrected of atmospheric attenuation. These corrections are done with a radiative transfer model Lowtran 6 and atmospheric vertical profiles given by radiosounding. First results for calculating areal evaporation in Finnish conditions are shown. The daily areal evapotranspiration, other surface fluxes, soil moisture, soil and canopy temperatures for July 1988 are calculated for one river basin having an area of about 1225 km^2. A comparison of the model against water balance method is presented.

1584 (SA-PUB–9/89-Vol.1, pp. 187-196) **Possible changes in forest hydrology following a global climatic change.** Lankreyer, H.J.M. (Univ. of Groningen, Harem (Netherlands). Dept. of Physical Geography and Soil Science); Veen, A.W.L. Academy of Finland, Helsinki (Finland). 1989. (CONF-8909491–Vol.1: Conference on climate and water, Helsinki (Finland), 11-15 Sep 1989). In *Conference on climate and water: Volume 1.* 520p. Order Number DE93721620. Source: OSTI; NTIS.

The parameterisation of forest evapotranspiration - as incorporated in a one-dimensional model, based on the Penman-Monteith equation - is applied to analyze interaction mechanisms in evaporation. Results are presented of a sensitivity study based on meteorological data, modified to simulate possible future climate conditions, and changed forest parameters. Higher rainfall and lower stomatal conductance will cause a significant increase of water draining from the forest soil. Reliability of rainfall predictions and of knowledge of stomatal reaction to climate change are recognised as important limitations.

1585 (SA-PUB–9/89-Vol.1, pp. 236-251) **Sensitivity of evapotranspiration and soil moisture to possible climatic changes.** Kuchment, L.S. (Water Problems Institute of the USSR Academy of Sciences, Moscow (USSR)); Motovilov, Y.G.; Startseva, Z.P. Academy of Finland, Helsinki (Finland). 1989. (CONF-8909491–Vol.1: Conference on climate and water, Helsinki (Finland), 11-15 Sep 1989). In *Conference on climate and water: Volume 1.* 520p. Order Number DE93721620. Source: OSTI; NTIS.

A physically based model of moisture transfer in the system 'soil - canopy - atmosphere' is used to estimate CO_2-induced changes in evapotranspirations. The model takes into account not only variations of atmosphere and vegetation characteristics, but also various mutual non-linear effects of heat and moisture transfer in soil and plants caused by these variations.

1586 (SA-PUB–9/89-Vol.1, pp. 252-261) **Soil moisture dynamics in South-Central Sweden in a 100 years perspective.** Andersson, L. (Sveriges Meteorologiska och Hydrologiska Inst., Norrkoeping (Sweden)). Academy of Finland, Helsinki (Finland). 1989. (CONF-8909491–Vol.1: Conference on climate and water, Helsinki (Finland), 11-15 Sep 1989). In *Conference on climate and water: Volume 1.* 520p. Order Number DE93721620. Source: OSTI; NTIS.

International fluctuations of soil moisture deficits in south-central Sweden were analyzed in a 100 year perspective with the help of a dynamic water partitioning model. Considerable fluctuations of 10, 30 and 50-year mean deficits, a general secular trend towards higher summer deficits and larger fluctuations around the median were revealed. In the light of the critical importance of the choice of time period, the concepts of return and standard periods were challenged. A Geographical Information System (GIS) was used to detect alterations of the spatial distribution of areas with different probability to act as recharge or discharge areas. Wetness impacting human interventions were shown to, on average, have caused a slight desiccation of the landscape, although the impacts locally could be large.

1587 (SA-PUB–9/89-Vol.2, pp. 89-99) **The examination of runoff and loss of soil in field experiments with special reference to precipitation.** Kerenyi, A. (Kossuth University, Debrecen (Hungary). Dept. of Geography). Academy of Finland, Helsinki (Finland). 1989. (CONF-8909491–Vol.2: Conference on climate and water, Helsinki (Finland), 11-15 Sep 1989). In *Conference on climate and water: Volume 2.* 393p. Order Number DE93721621. Source: OSTI; NTIS.

Surface runoff, loss of soil, and concentration of load were measured in four experimental plots from spring to autumn for a period of three years. The measurements were primarily focused on the quantity, intensity (average intensity, 20- and 30-minute maximum intensity), drop energy, and the specific drop power of precipitations. The experiments were performed in three different stages. In the first stage the plots remained bare, in the second two of the plots were covered with plastic nets, while in the third stage the measurements were carried out in four different combinations: in a bare control plot, in a plot covered with nets, in one overgrown with vegetation and, finally, in a plot covered with both a net and vegetation. It was found that specific drop power has a decisive role in the production of load. The relationship between the various rain parameters and initial erosion was determined by means of correlation calculation. The highest correlation coefficients were obtained in the case of the 20-minute maximum intensity and specific drop power variant. It was also demonstrated that in the case of rains following dry spells surface runoff diminishes while the water's load concentration increases.

1588 (SCPRI-RM–3-1992) **Monthly results of measurements; March 1992.** Service Central de Protection contre les Rayonnements Ionisants, 78 - Le Vesinet (France). 1992. 59p. (In French). Order Number DE93720993. Source: OSTI; NTIS (US Sales Only); INIS.

This report of the SCPRI exposes the main results concerning the routine monitoring of environmental radioactivity in France: atmospheric dusts, rainwater, surface water, underground water,

sewage water, drinking water, food chain (milk, vegetables, fishes), sea water around nuclear sites and other sites. The activities of various radioisotopes are presented in tables.

1589 (SCPRI-RM–4-1992) **Monthly results of measurements; April 1992.** Service Central de Protection contre les Rayonnements Ionisants, 78 - Le Vesinet (France). 1992. 42p. (In French). Order Number DE93720994. Source: OSTI; NTIS (US Sales Only); INIS.

This report of the SCPRI exposes the main results concerning the routine monitoring of environmental radioactivity in France: atmospheric dusts, rainwater, surface water, underground water, sewage water, drinking water, food chain (milk, vegetables, fishes), sea water around nuclear sites and other sites. The activities of various radioisotopes are presented in tables.

1590 (SCPRI-RM–5-1992) **Monthly results of measurements; May 1992.** Service Central de Protection contre les Rayonnements Ionisants, 78 - Le Vesinet (France). 1992. 42p. (In French). Order Number DE93720995. Source: OSTI; NTIS (US Sales Only); INIS.

This report of the SCPRI exposes the main results concerning the routine monitoring of environmental radioactivity in France: atmospheric dusts, rainwater, surface water, underground water, sewage water, drinking water, food chain (milk, vegetables, fishes), sea water around nuclear sites and other sites. The activities of various radioisotopes are presented in tables.

1591 (SCPRI-RM–06-1992) **Monthly results of measurements; Jun 1992.** Service Central de Protection contre les Rayonnements Ionisants, 78 - Le Vesinet (France). 1992. 54p. (In French). Order Number DE93721022. Source: OSTI; NTIS (US Sales Only); INIS.

This report of the SCPRI exposes the principal results concerning the routine monitoring of environmental radioactivity in France: atmospheric dusts, rainwater, surface water, underground water, sewage water, drinking water, food chain (milk, vegetables, fishes), sea water around nuclear sites and other sites. The activities of various radioisotopes are presented in tables.

1592 (SKB-TR–91-53) **Impact of a repository on permafrost development during glaciation advance.** Vallander, P. (VBB Viak AB, Stockholm (Sweden)); Eurenius, J. Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden). Dec 1991. 95p. Order Number DE93603575. Source: OSTI; NTIS; INIS.

The study concerns the development of permafrost during the initial phase of a glaciation period in an area in Sweden, where a generic repository for spent nuclear fuel of type KBS-3 was assumed be located 600 m below the ground surface. The bedrock was assumed to consist of granite which could be superposed by till. An aim of the study was to assess, by calculations, if prerequisites could be developed for a forced ground water flow from an adjacent lake, past the repository and then up to an un-frozen ground surface above the repository. Results from computer calculations, carried out with a finite element program for a total simulation period of 10000 years, and with varied assumptions regarding final mean air temperature 5000 year ahead, indicated that permafrost development will be about the same in the ground immediately above the repository as in surrounding ground, and that conditions for the mentioned ground water flow could prevail during less than 10 years. It was also indicated that the impact on permafrost development in a zone with anomalous heat generation would be insignificant in comparison with the impact from a repository. (11 refs., 60 figs.) (au).

1593 (SKB-TR–91-54) **Hydraulic evaluation of the groundwater conditions at Finnsjoen. The effects on dilution in a domestic well.** Axelsson, C.L. (Golder Geosystem AB, Uppsala (Sweden)); Bystroem, J.; Eriksson, Aa.; Holmen, J.; Haitjema, H.M. Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden). Sep 1991. 92p. Order Number DE93605410. Source: OSTI; NTIS; INIS.

The Swedish Nuclear Fuel and Waste Management Company (SKB) is presently performing a safety analysis study, SKB 91, for a final repository for spent nuclear fuel. The study is carried out for a generic repository located to the Finnsjoen area, which is one of SKBs oldest study-areas. An important part of the safety analysis is the dose calculations. Radionuclides can be transported to the biosphere via the sea, a lake, and via extraction of groundwater from drilled or dug wells. Thus, an important scenario to study is the dilution of radionuclides in a domestic well drilled in the future close to the repository. The present study is discussing; * Localization, drilling and construction of wells. * Specific capacities and chloride content of the rock mass and wells found in the Finnsjoe are. * Risk areas for future drilled wells. * Dilution in future wells drilled in fracture zones or in the hard rock in the vicinity of the repository. The evaluations show that a well pumping 6 m^3/day, located in a fracture zone or in the rock mass, has no influence on the local groundwater flow system except for the very vicinity of the well. Consequently, a well may be drilled in the hard rock without any risk of pumping groundwater that has passed the repository. Wells may also be located anywhere in fracture zones, except for in the very discharge area, without any risk of getting groundwater affected by the repository. Modelling indicate that a well drilled in the discharge area for contaminated groundwater, may collect all groundwater from the repository. However, this is based on assumptions of homogeneous continuous fracture zones with a high hydraulic conductivity compared to the rock mass, which will give rise to a concentrated discharge area. (44 refs., 31 figs., 6 tabs.) (au).

1594 (SKB-TR–91-56) **Microbes in crystalline bedrock. Assimilation of CO_2 and introduced organic compounds by bacterial populations in groundwater from deep crystalline bedrock at Laxemar and Stripa.** Pedersen, K. (University of Goeteborg, Dept. of General and Marine Microbiology, Goeteborg (Sweden)); Ekendahl, S.; Arlinger, J. Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden). Dec 1991. 65p. Order Number DE93603576. Source: OSTI; NTIS; INIS.

The assimilation of CO_2 and of introduced organic compounds by bacterial populations in deep groundwater from fractured crystalline bedrock has been studied. Three depth horizons of the subvertical boreholes KLZ01 at Laxemar in southeastern Sweden, 830-841 m, 910-921 m and 999-1078 m, and V2 in the Stripa mine, 799-807m 812-820 m and 970-1240 m were sampled. The salinity profile of the KLX01 borehole is homogeneous and the groundwater had the following physico-chemical characteristics: pH values of 8.2, 8.4 and 8.5; Eh values of 270, no data and -220 mV; sulphide: 2.3, 11.0 and 5.6 μM; CO_3^{2-}: 104, 98 and 190 μM; CH_4: 26, 27 and 31 μl/l and N_2: 47, 25 and 18 ml/l, respectively. The groundwater in V2 in Stripa were obtained from fracture systems without close hydraulic connections and had the following physico-chemical characteristics: pH values of 9.5, 9.4 and 10.2; Eh values of +205, +199 and -3 mV; sulphide: 0, 106 and 233 μM; CO_3^{2-}: 50, 57 and 158 μM; CH_4: 245, 170 and 290 μl/l and N_2: 25, 31 and 25 ml/l, respectively. Biofilm reactors with hydrophilic glass surfaces were connected to the flowing groundwaters from each of the 3 depths with flow rates of approximately $3x10^{-3}$ m sec^{-1} over 19 days in Laxemar and 27 to 161 days in Stripa. There were between 0.15 to 0.68 x 10^5 unattached bacteria ml^{-1} groundwater and 0.94 to 1.2 x 10^5 attached bacteria cm^{-2} on the surface in Laxemar and from 1.6 x 10^3 up to 3.2 x 10^5 bacteria ml^{-1} groundwater and from 2.4 x 10^5 up to 1.1 x 10^7 bacteria cm^{-2} of colonized test surfaces in Stripa. Assuming a mean channel width of 0.1 mm, our results imply that there would be from 10^3 up to 10^6 more attached than unattached bacteria in a water conducting channel in crystalline bedrock. (54 refs., 23 figs., 10 tabs.) (au).

1595 (SKB-TR–91-58) **Exploratory calculations concerning the influence of glaciation and permafrost on the groundwater flow system, and an initial study of permafrost influences at the Finnsjoen site - an SKB 91 study.** Lindbom, B. (Kemakta Konsult AB, Stockholm (Sweden)); Boghammar, A. Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden). Dec 1991. 60p. Order Number DE93603577. Source: OSTI; NTIS; INIS.

The present report describes some exploratory calculations concerning the potential groundwater flow during the recession phase of a future glaciation. The exercise forms part of the SKB 91 performance assessment project, and aims at qualitatively illustrating the prevailing hydrological phenomena under extreme glacier conditions, and at quantitatively indicating the order of magnitudes for

the groundwater flows that can be expected during the withdrawal of an ice-sheet. The interest has been focussed on the deglaciation phase, since it can be expected that large amounts of water are available for infiltration at this time. Conditions assuming either intact or melted away permafrost were considered within the project. Apart from the exploratory calculations mentioned above, an initial attempt at modelling a permafrost situation at the Finnsjoen site was carried out. This part of the study did not include the presence of melting-water, but was focussed on the potential occurrence of permafrost and its impact on the groundwater flow as a potential barrier. These calculations are reported separately in an Appendix. Neither part of the project addressed the conceptual uncertainties like potential crustal downwarping, thermal buoyancy effects by the heat evolution from the repository, fracture zone conductivities being affected by the overburden from the ice-shelf, etc, etc. The project made use of the finite element code NAMMU for solving the equation system, while the program package HYPAC was used for pre- and postprocessing purposes. (au).

1596 (SKB-TR–91-61) **Heat propagation from a radioactive waste repository. SKB 91 reference canister.** Thunvik, R. (Royal Inst. of Technology, Stockholm (Sweden)); Braester, C. Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden). Mar 1991. 43p. Order Number DE93603605. Source: OSTI; NTIS; INIS.

A study of heat propagation around a hypothetical radioactive waste repository is presented. The investigated flow domain was limited to a quarter of the flow domain around a single canister due to symmetry by vertical planes passing through the centre of the canister, half distance between the adjacent tunnels and the adjacent canisters. Strictly speaking, such an approach is applicable to a repository of infinite extent. However, from a practical point of view this assumption applies to all canisters but the ones close to the edge of the repository. The following different material regions were considered: (a.) Canister containing the spent fuel, (b.) Buffer (bentonite) around the canister, (c.) Backfilled (mixture of bentonite and sand) tunnels, and (d.) host Rock. The canister material was presented by a 'homogenized' medium obtained by weighted averaging of the main constituents of the canister, viz. spent fuel, copper and lead. A geothermal gradient of 13 degrees C/km was assumed. The initial heat effect per canister was 1066 W. The total vertical extent of the flow domain considered was about 1500 meters. The base case, with 6.2 m canister spacing and 30 m tunnel spacing, resulted in a maximum temperature at the canister/buffer interface of about 66 degrees C (corresponding to a temperature rise of about 54 degrees C), and about 50 degrees C (about 38 degrees C temperature rise) in the rock. (au).

1597 (SKB-TR–92-02) **Sternoe study site. Scope of activities and main results.** Ahlbom, K. (Conterra AB, Uppsala (Sweden)); Andersson, J.E.; Nordqvist, R.; Tiren, S.; Ljunggren, C.; Voss, C. Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden). Jan 1992. 68p. Order Number DE93603578. Source: OSTI; NTIS; INIS.

During the period from 1977-1986 SKB (Swedish Nuclear Fuel and Waste Management Co) performed surface and borehole investigations of 14 study sites for the purpose of assessing their suitability for a repository of spent nuclear fuel. The next phase in the SKB site selection programme will be to perform detailed characterization, including characterization from shafts and/or tunnels, of two or three sites. The detailed investigations will continue over several years to provide all the data needed for a licensing application to build a repository. Such an application is foreseen to be given to the authorities around the year 2003. It is presently not clear if anyone of the previously investigated study sites will be selected as a site for detailed characterization. Other sites with geological and/or socio-economical characteristics judged more favourable may very well be the ones selected. However, as a part of the background documentation needed for the site selection studies to come, summary reports will be prepared for most study sites. These reports will include scope of activities, main results, uncertainties and need of complementary investigations. This report concerns the Sternoe study site. This site was one of the first sites to be investigated by SKB . The studies at Sternoe were made under severe time-constraints and with prototype borehole instrumentations. These limitations should be kept in mind when reading the report. (41 refs., 16 figs., 12 tabs.) (au).

1598 (SKB-TR–92-06) **Characterization of nearfield rock - A basis for comparison of repository concepts.** Pusch, R. (Clay Technolgy AB and Lund Univ. of Technology, Lund (Sweden)); Hoekmark, H. Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden). Dec 1991. 145p. Order Number DE93603579. Source: OSTI; NTIS; INIS.

The hydraulic conductivity of the nearfield rock controls the rate of wetting of adjacent buffer material as well as the rate of degradation of its smectite content and of the transport of radionuclides from the buffer/rock interface. Comparison of different repository concepts with respect to the function of the nearfield rock requires a common rock structure model, which is suggested in the report. Applying this model and 2D and 3D numerical calculations for evaluation of stress-induced structural changes, major differences between the three concepts VDH, KBS3 and VLH concerning the hydraulic conductivity of the nearfield have been identified. The importance of the orientation of the excavations turns out to be particularly obvious. Further development of the rock structure model is concluded to offer ways of quantifying more accurately the damaging effects of blasting and TBM-drilling. (au).

1599 (SKB-TR–92-07) **Discrete fracture modelling of the Finnsjoen rock mass: Phase 2.** Geier, J.E. (Golder Geosystem AB, Uppsala (Sweden)); Axelsson, C.L.; Haessler, L.; Benabderrahmane, A. Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden). Apr 1992. 293p. Order Number DE93603580. Source: OSTI; NTIS; INIS.

A discrete fracture network (DFN) model of the Finnsjoen site was derived from field data, and used to predict block-scale flow and transport properties. The DFN model was based on a compound Poisson process, with stochastic fracture zones, and individual fracture concentrated around the fracture zones. This formulation was used to represent the multitude of fracture zones at the site which could be observed on lineament maps and in boreholes, but were not the focus of detailed characterization efforts. Due to a shortage of data for fracture geometry at depth, distributions of fracture orientation and size were assumed to be uniform throughout the site. Transmissivity within individual fracture planes was assumed to vary according to a fractal model. Constant-head packer tests were simulated with the model, and the observed transient responses were compared with actual tests in terms of distributions of interpreted transmissivity and flow dimension, to partially validate the model. Both simulated and actual tests showed a range of flow dimension from sublinear to spherical, indicating local variations in the connectivity of the fracture population. A methodology was developed for estimation of an effective stochastic continuum from the DFN model, but this was only partly demonstrated. Directional conductivities for 40 m block were estimated using the DFN model. These show extremely poor correlation with results of multiple packer tests in the same blocks, indicating possible limitation of small-scale packer tests for predicting block-scale properties. Estimates are given of effective flow porosity and flow wetted surface, based on the block-scale flow fields calculated by the DFN model, and probabilistic models for the relationships among local fracture transmissivity, void space, and specific surface. The database for constructing these models is extremely limited. A review is given of the existing database for single fracture hydrologic properties. (127 refs.)

1600 (SKB-TR–92-08) **Statistical inference and comparison of stochastic models for the hydraulic conductivity at the Finnsjoen-site.** Norman, S. (Starprog AB (Sweden)). Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden). Apr 1992. 136p. Order Number DE93603581. Source: OSTI; NTIS; INIS.

The origin of this study was to find a good, or even the best, stochastic model for the hydraulic conductivity field at the Finnsjoe site. The conductivity field in question are regularized, that is upscaled. The reason for performing regularization of measurement data is primarily the need for long correlation scales. This is needed in order to model reasonably large domains that can be used when describing regional groundwater flow accurately. A theory of regularization is discussed in this report. In order to find the

best model, jacknifing is employed to compare different stochastic models. The theory for this method is described. In the act of doing so we also take a look at linear predictor theory, so called kriging, and include a general discussion of stochastic functions and intrinsic random functions. The statistical inference methods for finding the models are also described, in particular regression, iterative generalized regression (IGLSE) and non-parametric variogram estimators. A large amount of results is presented for a regularization scale of 36 metre. (30 refs.) (au).

1601 (SKN–58) **Basis for localization facilities for final disposal of spent nuclear fuel. Part 1: General geological survey.** Lundqvist, T. (Svensk Ingenjoerstjaenst SINTAB AB, Bromma (Sweden)); Samuelsson, L.; Scherman, S. National Board for Spent Nuclear Fuel, Stockholm (Sweden). Apr 1992. 72p. (In Swedish). Order Number DE93605432. Source: OSTI; NTIS; INIS.

A review of the knowledge on the Swedish bedrock with application to geologic disposal of spent nuclear fuel waste in crystalline rock.

1602 (SKN–62) **Simulation of the migration in fracutred rock by a model based on capillary tubes.** Dahlbom, P. (Lund Univ. (Sweden). Dept. of Water Resources Engineering). National Board for Spent Nuclear Fuel, Stockholm (Sweden). May 1992. 47p. Order Number DE93603558. Source: OSTI; NTIS; INIS.

In this paper the ability of a model based upon capillary tubes to reproduce the hydrodynamic dispersion in connection with flow of contaminated groundwater in fractured rock is investigated. It is assumed that the cross sectional areas are circular and that the flow is laminar. The molecular diffusion is neglected as well as the impact of variations in velocity over the cross-sectional area. It is assumed that the cross sectional areas in an ensemble of tubes belong to a gamma distribution. The velocity differences between tubes having different cross sectional area cause hydrodynamic dispersion. The model is applied to field tracer experiments at two sites. It is shown that the mean size of the cavities is smaller at a large depth and that the distribution is more narrow. The parameter in the gamma distribution has to be given different values to reproduce the breakthrough course at the different sites. It is also pointed out that there is no general relation between conductivity of a porous medium and its porosity without consideration of the pore size distribution. (au).

1603 (SKN–63) **Hydraulic gradients in rock aquifers.** Dahlblom, P. (Lund Univ. (Sweden). Dept. of Water Resources Engineering). National Board for Spent Nuclear Fuel, Stockholm (Sweden). May 1992. 73p. Order Number DE93603559. Source: OSTI; NTIS; INIS.

This report deals with fractured rock as a host for deposits of hazardous waste. In this context the rock, with its fractures containing moving groundwater, is called the geological barrier. The desired properties of the geological barrier are low permeability to water, low hydraulic gradients and ability to retain matter dissolved in the water. The hydraulic gradient together with the permeability and the porosity determines the migration velocity. Mathematical modelling of the migration involves calculation of the water flow and the hydrodynamic dispersion of the contaminant. The porous medium approach can be used to calculate mean flow velocities and hydrodynamic dispersion of a large number of fractures are connected, which means that a large volume have to be considered. It is assumed that the porous medium approach can be applied, and a number of idealized examples are shown. It is assumed that the groundwater table is replenished by percolation at a constant rate. One-dimensional analytical calculations show that zero hydraulic gradients may exist at relatively large distance from the coast. Two-dimensional numerical calculations show that it may be possible to find areas with low hydraulic gradients and flow velocities within blocks surrounded by areas with high hydraulic conductivity. (au).

1604 (STRIPA-TR–91-34) **Final report of the rock sealing project - Sealing of the near-field rock around deposition holes by use of bentonite grouts.** Boergesson, L. (Clay Technology AB, Lund (Sweden)); Pusch, R.; Fredrikson, A.; Hoekmark, H.; Karnland, O.; Sanden, T. Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden). Dec 1991. 194p. Order Number DE93603560. Source: OSTI; NTIS; INIS.

Test 1 of the rock sealing project comprised determ ination of the hydraulic properties of the rock around large-diameter holes like canister deposition holes or TBM tunnels and attempts were made to seal the fractures intersecting such holes with bentonite slurry. The heater holes from the buffer mass test which are 76 cm in diameter, were used and injection made from inside the holes with a specially designed device using dynamic injection technique. The hydraulic properties of the surrounding rock were tested by use of the same device before and after the injections, as well as after a 3 months heat pulse. The results were interpreted by applying a special derived grout flow model and by analyzing the rock response through different calculation techniques, as well as by localizing the injected grout by rock excavation. The experiments showed that grouting of fractured rock by using the applied technique can give very significant sealing. (au).

1605 (STRIPA-TR–92-01) **Modelling tracer transport in fractured rock at Stripa.** Herbert, A. (AEA Decommissioning and Radwaste, Oxfordshire (United Kingdom). Harwell Laboratory); Lanyon, G. Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden). Jan 1992. 198p. Order Number DE93603561. Source: OSTI; NTIS; INIS.

We present the results of a modelling study, making predictions for tracer transport experiments carried out within the H-zone feature in the Stripa mine. We use a direct fracture network approach to represent the system of interconnected flow-conducting fractures comprising this zone. It is a highly fractured granite, and our fracture-network models include up to 60000 fractures. We have had to develop efficient algorithms to calculate the flow and transport through these networks; these techniques are described and justified. The first stage of modelling addressed two saline injection experiments. The results of these were known to us and so in addition to 'predicting' the results of these experiments, we used them to calibrate a flow model of the experimental site. This model was then used to make true 'blind' predictions for a set of tracer experiments carried out in the natural head-field, caused by an open drift. Where our flow model was good, our predictions were found to be very accurate, explaining the dispersion in the tracer breakthrough in terms of the fracture network geometry. Discrepancies for experiments in less well characterised regions of the H-zone are presented, and we suggest that the errors in these predictions are a consequence of the inaccuracies of the flow-field. We have demonstrated the use of large-scale fracture network modelling. It has proved very successful, and made very accurate predictions of field experiments carried out at the Stripa mine. The measured dispersion of tracers can be accounted for by the geometry of the fracture network flow system. (14 refs.) (au).

1606 (STRIPA-TR–92-02) **Site characterization and validation - tracer migration experiment in the validation drift, report 1: instrumentation site preparation and tracers.** Birgersson, L. (Kemakta Consultants Co., Stockholm (Sweden)); Aagren, L. Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden). Jan 1992. 102p. Order Number DE93603586. Source: OSTI; NTIS; INIS.

The tracer migration experiment has been performed as a part of the site characterization and validation project in the Stripa experimental mine. Tracers were injected in sealed off borehole sections in the average fractured rock and in a 6 m wide fracture zone intersecting a 50 m long drift. Distances from the tracer injection sections to the drift were 10-25 m. Plastic sheets and short sumpholes were used to collect water and tracers emerging into the drift in 270 sampling areas, each with the size of 1-2 m^2. Tracer concentrations were measured during 10 months and breakthrough curves were obtained for seven injection sections. This report described the experimental layout of the experiment and the equipment used. It also points at advantages/disadvantages with the two sets of tracers used in the experiment; dyes and metal complexes. (au).

1607 (STRIPA-TR–92-03(pt.1)) **Site characterization and validation - Tracer migration experiment in the validation drift, report 2, part 1: performed experiments, results and evaluation.** Birgersson, L. (Kemakta Consultatnts Co., Stockholm

(Sweden)); Widen, H.; Aagren, T.; Neretnieks, I.; Moreno, L. Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden). Jan 1992. 272p. Order Number DE93603587. Source: OSTI; NTIS; INIS.

This report is the second of the two reports describing the tracer migration experiment where water and tracer flow has been monitored in a drift at the 385 m level in the Stripa experimental mine. The tracer migration experiment is one of a large number of experiments performed within the Site Characterization and Validation (SCV) project. The upper part of the 50 m long validation drift was covered with approximately 150 plastic sheets, in which the emerging water was collected. The water emerging into the lower part of the drift was collected in short boreholes, sumpholes. Sex different tracer mixtures were injected at distances between 10 and 25 m from the drift. The flowrate and tracer monitoring continued for ten months. Tracer breakthrough curves and flowrate distributions were used to study flow paths, velocities, hydraulic conductivities, dispersivities, interaction with the rock matrix and channelling effects within the rock. The present report describes the structure of the observations, the flowrate measurements and estimated hydraulic conductivities. The main part of this report addresses the interpretation of the tracer movement in fractured rock. The tracer movement as measured by the more than 150 individual tracer curves has been analysed with the traditional advection-dispersion model and a subset of the curves with the advection-dispersion-diffusion model. The tracer experiments have permitted the flow porosity, dispersion and interaction with the rock matrix to be studied. (57 refs.).

1608 (STRIPA-TR–92-03(pt.2)) **Site characterization and validation - Tracer migration experiment in the validation drift, report 2, Part 2: breakthrough curves in the validation drift appendices 5-9.** Birgersson, L. (Kemakta Consultants Co., Stockholm (Sweden)); Widen, H.; Aagren, T.; Neretnieks, I.; Moreno, L. Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden). Jan 1992. 390p. Order Number DE93603588. Source: OSTI; NTIS; INIS.

Flowrate curves for the 53 sampling areas in the validation drift with measureable flowrates are given. The sampling area 267 is treated as three separate sampling areas; 267:1, 267:2 and 267:3. The total flowrate for these three sampling areas is given in a separate plot. The flowrates are given in ml/h. The time is given in hours since April 27 00:00, 1990. Disturbances in flowrates are observed after 8500 hours due to opening of boreholes C1 and W1. Results from flowrate measurements after 8500 hours are therefore excluded. The tracer breakthrough curves for 38 sampling areas in the validation drift are given as concentration values versus time. The sampling area 267 is treated as three separate sampling areas; 267:1, 267:2 and 267:3. This gives a total of 40 breakthrough curves for each tracer. (au).

1609 (STRIPA-TR–92-05) **Prediction of flow and drawdown for the site characterization and validation site in the Stripa mine.** Long, J. (Earth Sciences Division LBL, University of California, Berkeley, CA (United States)); Mauldon, A.; Nelson, K.; Martel, S.; Fuller, P.; Karasaki, K. Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden). Jan 1992. 130p. Order Number DE93603590. Source: OSTI; NTIS; INIS.

Geophysical and hydrologic data from a location in the Stripa mine in Sweden (Site Characterization and Validation (SCV) block) has been used to create a series of models for flow through the fracture network. The models can be characterized as 'equivalent discontinuum' models. Equivalent discontinuum models are derived starting from a specified lattice or 'template'. An inverse analysis called 'simulated annealing' is used to make a random search through the elements of the lattice to find a configuration that can reproduce the measured responses. Evidence at Stripa points to hydrology dominated by fracture zones. These have been identified and located. Lattice templates were arranged to lie on the fracture zones identified by Black and Olsson. Goal of this project was to build a fracture flow model based on an initial data set, and use this model to make predictions of the flow behavior during a new test. Then given data from the new test, predict a second test, etc. The first data set was an interference test called C1-2. Both a two-dimensional and a three-dimensional model were annealed to the C1-2 data and use this model to predict the behavior of the Simulated Drift Experiment (SDE). The SDE measured the flow into, and drawdown due to reducing the pressure in a group of 6 parallel boreholes. Then both the C1-2 and SDE data were used to predict the flow into a drawdown due to an excavation, the Validation Drift (VD), made through the boreholes. Finally, all the data was used to predict the hydrologic response to opening another hole, T1. Annealing to the C1-2 test gave an excellent prediction of the SDE. The VD effects were dominated by near-field physics that were not predictable. However, the calculations and measurements could be used to postulate that a dramatic decrease in hydraulic conductivity near the drift was due to degassing of nitrogen as the inflowing water was depressurized.

1610 (STRIPA-TR–92-06) **Simulation of tracer transport for the site characterization and validation site in the Stripa mine.** Long, J. (Earth Science Division, LBL Univ. of California, Berkeley (United States)); Karasaki, K. Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden). Jan 1992. 104p. Order Number DE93603591. Source: OSTI; NTIS; INIS.

Tracer simulations for transport in a fracture zone were made based on two equivalent discontinuum models of a fracture zone (the H-zone) at the Stripa mine. The two models were derived from simulated annealing inversions of hydraulic tests in the H-zone. A comparison with the data shows that, in general the simulations are able to predict arrival time quite well. This means that the information from the interference tests was a good prediction of tracer travel path length. Prediction of the maximum C/C_o was not as good but was fairly close in about half the predictions. The most important recommendation of this report is that future studies of tracer transport in fracture networks should be done solely from boreholes which are held at pressures above atmospheric to maintain single phase conditions. There are many things that are not fully understood about the physics of the transport phenomenon in fractures and coupling these two problems makes it very difficult to interpret the experiments. The SCV project has shown clearly that the hydrology of excavations is not well understood. (au).

1611 (STRIPA-TR–92-07) **A comparison of measurements and calculations for the Stripa validation drift inflow experiment.** Hodgkinson, D.P. (Intera Information Tehnologies, Henley-on-Thames (United Kingdom)); Cooper, N.S. Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden). Jan 1992. 103p. Order Number DE93603592. Source: OSTI; NTIS; INIS.

This data presents a comparison of measurements and predictions for groundwater flow to the validation drift and remaining portions of the D-holes in the Site Characterisation and Validation (SCV) block. The comparison was carried out of behalf of the Stripa task force on fracture flow modelling. The paper summarises the characterisation data and their preliminary interpretation, and reviews the fracture flow modelling approaches and predictions made by teams from AEA Technology/Fracflow, Golder Associated and Lawrence Berkely Laboratory. The predictions are compared with the inflow measurements on the basis of the validation process and criteria defined by the Task Force. The results of all three modelling groups meet the validation criteria, with the predictions of the inflow being of the same order of magnitude as the observations. Also the AEA/Fracflow and Golder approaches allow the inflow pattern to be predicted and this too is reproduced with reasonable accuracy. The successful completion of this project demonstrates the feasibility of discrete fracture flow modelling, and in particular the ability to collect and analyse all the necessary characterization data in a timely and eccnomic manner. (32 refs.) (au).

1612 (STRIPA-TR–92-08) **Final report of the rock sealing project - identification of zones disturbed by blasting and stress release.** Boergesson, L. (Clay Technology AB, Lund (Sweden)); Pusch, R.; Fredriksson, A.; Hoekmark, H.; Karnland, O.; Sanden, R. Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden). Jan 1992. 211p. Order Number DE93603562. Source: OSTI; NTIS; INIS.

Tests 2 and 3 of the rock sealing project comprised determination of the hydraulic properties of the disturbed rock around tunnels and drifts and the possibilities of decreasing the hydraulic conductivity of the disturbed zones by an attempt to seal the very fine

fractures that are causing the increased conductivity. This report deals with the hydraulic testing while the grouting procedures and their effect are described in volume 3. The BMT drift was used for the experiments which basically consisted of measuring the flow of water from an inner pressurized slot and borehole curtain to an outer curtain with zero water pressure (Macro Flow Test). The 12 m long drift was sealed from water inflow by a slurry that filled the entire drift. The slurry was pressurized by a large water filled bladder for eliminating leakage along and through the drift. The flow tests were primarily evaluated by finite element modeling in which the rock was considered an equivalent porous medium. Two possible rock models were developed that satisfied not only the flow and water pressure measurements during the macro flow test but also 3 different flow situations preceding the test. The models imply a shallow blast-disturbed zone with a strongly increased hydraulic conductivity, and a stress disturbed zone with a decreased radial hydraulic conductivity. The main difference between the models is the extension of the blast-damaged zone and the axial hydraulic conductivity of the stress disturbed zone. (au).

1613 (STRIPA-TR–92-09) **A compilation of minutes for the Stripa task force on fracture flow modelling.** Hodgkinson, D. (Intera Information Technologies, Henley-on-Thames (United Kingdom)). Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden). Jan 1992. 215p. Order Number DE93603593. Source: OSTI; NTIS; INIS.

This report is a compilation of minutes from the nine meetings of the Stripa task force on fracture flow modelling, held at various locations around the world from February 1988 to December 1991. The task force was set up as a peer review group with the specific objectives of 1. recommending criteria for the verification and validation of fracture flow models, 2. facilitating the dissemination of information to countries participating in the Stripa project, and 3. coordinating the work of the three modelling groups form AEA Harwell, Golder Associates and Lawrence Berkeley Laboratory. The report provides a detailed technical commentary of the interplay between the development and application of mathematical models, and the design, execution and interpretation of experiment, within a structured project management framework. In particular, the task force has pioneered the definition and implementation of a validation process and associated criteria based on the analysis of a wide range of experimental data. (au).

1614 (STRIPA-TR–92-10) **A site characterization and validation - Porous media modelling of validation tracer experiments.** MacLeod, R. (Fracflow Consultants Inc., St. Johns, NF (Canada)); Gale, J.; Bursey, G. Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden). Jan 1992. 137p. Order Number DE93603594. Source: OSTI; NTIS; INIS.

A three dimensional porous media model of the SCV site was developed to predict the observed hydraulic head distribution in the SCV site as well as the measured flux to the D boreholes during the simulated drift experiment (SDE) and the flux to the Validation drift. The SCV flux model was calibrated to reproduce the observed distribution of flux in the D boreholes and the validation drift and was used as the basis for simulating the solute transport of the tracer experiments carried out in the SCV site. The SCV transport model was calibrated using the measured breakthrough curves for the saline tracer tests. The porous media numerical simulations of the validation tracer experiments were designed to predict the transport of conservative tracers through the rock mass from selected boreholes in the SCV site. This prediction consisted of computing the tracer breakthrough curves for the validation drift as well as predicting t_5 and t_{50}, time to reach 5% and 50% of the 'steady state' breakthrough, and C_{ss}/C_o, the normalized steady state breakthrough concentrations for each experiment. The computed distribution of hydraulic heads and tracer concentrations indicates that there is a relatively strong horizontal as well as vertical gradient in the H zone. Tracer from the more distant boreholes appears to bypass the drift and only appears in the drift as a result of lateral dispersion. A preliminary comparison of the predicted tracer results with the measured results, based on the breakthrough curves and values of t_5, shows that in general the predicted tracer arrival times at the drift were too early and the predicted steady state relative concentrations of tracer were lower than measured. (au).

1615 (STRIPA-TR–92-11) **Fully-coupled hydro-mechanical modelling of the D-holes and validation drift inflow.** Monsen, K. (Norwegian Geotechnical Inst., Oslo (Norway)); Barton, N.; Makurat, A. Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden). Feb 1992. 48p. Order Number DE93603595. Source: OSTI; NTIS; INIS.

This report presents the results from fully-coupled hydro-mechanical modelling of the D-hole and drift inflows. Joints represented in Harwells stochastically generated 8m x 8m x 8m cubes were used to select two possible joint geometries for two-dimensional rock mechanics simulations of the 2.8 x 2.2m validation drift, and the rock mass response to its excavation. The joints intersecting the four end faces of these cubes were set up in distinct element UDEC-BB models and loaded with boundary stresses of 10 MPa vertically and 14 MPa horizontally. In numerical models 5 and 8, which were run first as mechanical response (M) models (TR 91-05), full H-M coupling was performed, with calculations of inflow. In general, response to excavation was a little stronger than in hte un-coupled mechanical response (M) modelling. In the D-hole simulations, however, channel development int he disturbed zone could not occur due to less displacement taking place in the rock mass. For this reason, the stress levels were also generally much more moderate, preventing the joints from closing as much as in the drift simulations. Consequently, the D-hole model had a much better radial connectivity. It was possible to observe that the radial inflow to the D-holes was significantly higher than the flow into the drift models. However, due to the extremely small joint apertures involved ($<1\mu$m), time steps and calculation times were very slow in the H-M models, and although mechanical behaviour appeared to have reached equilibrium, there was evidence of continued transients in some of the flow regions. The drift excavation caused nearly total closing of critical joints due to local normal stress inceases. Near-blockage of fluid transportation routes was demonstrated. (au).

1616 (STRIPA-TR–92-12) **Rock mechanics characterization and modelling of the disturbed zone phenomena at Stripa.** Barton, N. (Norwegian Geotechnical Inst., Oslo (Norway)); Makurat, A.; Monsen, K.; Vik, G.; Tunbridge, L. Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden). Feb 1992. 64p. Order Number DE93603596. Source: OSTI; NTIS; INIS.

The rock mechanics test programme undertaken by NGI in Phase 3 of the Stripa project consisted initially of small scale joint characterisation using 100 mm drill core, and larger scale coupled testing of the hydro-mechanical behaviour of joints. Stress-closure-flow and shear-dilation-flow testing was performed in joints of 200 mm length in NGI's CSFT apparatus, and on a joint of 1400 mm length using a 1m x 1m in situ block test in the floor of the 3D drift. The subsequent numerical modelling using the discrete element code UDEC-BB was directed towards the investigation of potential excavation-induced changes in joint aperture and permeability caused by the validation drift. The net effects were expected to be changed radial permeability that might be reduced locally, and changed axial permeability that might be increased locally. Comparisons were made between the mechanical behaviour of continuum models, and jointed models with either average joint properties (models 1 to 4) or joint-length-dependent properties (models 5 to 8). Significant differences were noted. UDEC-BB models with fully coupled (hydro-mechanical) behaviour were also run to compare inflows into a simulated drift (SDE) D-hole model with inflows into a drift excavation in the same joint model. Flow was found to reduce from 0.12 litres/min. per 1 m length of D-holes to 0.03 litres/min. per 1 m length of validation drift. In practice, an 80 to 90% reduction in inflow has been observed between D-holes and drift excavation, but in both cases inflows are about and order of magnitude less than the above. (23 refs.) (au).

1617 (STRIPA-TR–92-13) **Site characterization and validation - Head variations during the entire experimental period.** Haigh, D. (Golder Associates Ltd., Nottingham (United Kingdom)); Brightman, M.; Black, J.; Parry, S. Swedish Nuclear Fuel and

Waste Management Co., Stockholm (Sweden). Jan 1992. 122p. Order Number DE93603597. Source: OSTI; NTIS; INIS.

The site characterization and validation project lasted for five years from 1986 to 1991. It consisted of a number of experiments within the region known as the SCV site. During this period of experimentation a monitoring system was established within the mine for the purpose of measuring the variation of head at a number of locations within and around the site. The system installed was based around a set of equipment known as a Piezomac ™ system. In this system there is one central pressure transducer and each borehole interval is connected to it in turn. It can measure up to 55 separate points during each measurement 'cycle'. Monitoring points were either complete boreholes or sections of boreholes isolated by packers. In order to produce reasonable file size, data sets were screened. The results show that the SCV site was always responding to some form of hydrogeological disturbance. Many key tests were performed against changing background trends. This was particularly so of the simulated drift experiment and the large scale crosshole tests. However, some estimates of long term equilibrium heads before and after excavation of the validation drift have been made. Contoured plots of heads before and after show significant reduction of steady state heads as a result of drift excavation. Furthermore contouring the estimated long term drawdowns responding to the simulated drift experiment shows the specific influence of the H zone and the A/B zone. Overall the results of the monitoring show that the mine was a very active hydrogeological environment during the experimentation. Additionally it was often very difficult to clearly identify the causes of such disturbances. (au).

1618 (STRIPA-TR–92-15) **Discrete fracture modelling for the Stripa tracer validation experiment predictions.** Dershowitz, W. (Golder Associates Inc., Redmond, WA (United States)); Wallmann, P. Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden). Feb 1992. 119p. Order Number DE93603599. Source: OSTI; NTIS; INIS.

Groundwater flow and transport through three-dimensional networks of discrete fractures was modeled to predict the recovery of tracer from tracer injection experiments conducted during phase 3 of the Stripa site characterization and validation protect. Predictions were made on the basis of an updated version of the site scale discrete fracture conceptual model used for flow predictions and preliminary transport modelling. In this model, individual fractures were treated as stochastic features described by probability distributions of geometric and hydrologic properties. Fractures were divided into three populations: Fractures in fracture zones near the drift, non-fracture zone fractures within 31 m of the drift, and fractures in fracture zones over 31 meters from the drift axis. Fractures outside fracture zones are not modelled beyond 31 meters from the drift axis. Transport predictions were produced using the Frac-Man discrete fracture modelling package for each of five tracer experiments. Output was produced in the seven formats specified by the Stripa task force on fracture flow modelling. (au).

1619 (STRIPA-TR–92-17) **Geochemical modelling of grout-groundwater-rock interactions at the seal-rock interface.** Alcorn, S. (RE/SPEC Inc., Albuquerque, NM (United States)); Christian-Frear, T. Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden). Feb 1992. 64p. Order Number DE93603600. Source: OSTI; NTIS; INIS.

Theoretical investigations into the longevity of repository seals have dealt primarily with the development of a methodology to evaluate interactions between portland cement-based grout and groundwater. Evaluation of chemical thermodynamic equilibria among grout, groundwater, and granitic host rock phases using the geochemical codes EQ3NR/EQ6 suggests that a fracture filled with grout and saturated with groundwater will tend to fill and 'tighten' with time. These calculations predict that some grout and rock phases will dissolve, and that there will be precipitation of secondary phases which collectively have a larger overall volume than that of the material dissolved. Model assumptions include sealing of the fracture in a sluggish hydrologic regime (low gradient) characterized by a saline groundwater environment. The results of the calculations suggest that buffering of the fracture seals chemical system by the granitic rock may be important in determining the long-term fate of grout seals and the resulting phase assemblage in the fracture. The similarity of the predicted reaction product phases to those observed in naturally filled fractures suggests that with time equilibrium will be approached and grouted fractures subject to low hydrologic gradients will continue to seal. If grout injected into fractures materially reduces groundwater flux, the approach to chemical equilibrium will likely be accelerated. In light of this, even very thin or imperfectly grouted fractures would tighten in suitable hydrogeologic environments. In order to determine the period of time necessary to approach equilibrium, data on reaction rates are required. (au).

1620 (STRIPA-TR–92-20) **A comparison of measurements and calculations for the Stripa tracer experiments.** Hodgkinson, D.P. (Intera Information Technologies, Henley-on-Thames (United Kingdom)); Copper, N.S. Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden). Mar 1992. 156p. Order Number DE93603601. Source: OSTI; NTIS; INIS.

This paper presents a comparison of measurements and predictions for migration of tracers from boreholes to the validation drift and to other boreholes in the Site Characterisation and Validation (SCV) block. The comparison was carried out on behalf of the Stripa task force on fracture flow modelling. The paper summarises the radar/saline tracer experiments, the tracer migration experiment observations and reviews the fracture flow and tracer transport modelling approaches and predictions made by AEA Technology, Fracflow Consultants, Golder Associates and Lawrence Berkeley Laboratory. The predictions are compared with the observed breakthrough curves on the basis of the validation process and criteria defined by the task force. The results of all four modelling groups met the validation criteria, with the predictions of the tracer breakthrough concentrations and times being within an order of magnitude of the observations. Also the AEA and Golder approaches allow the spatial distribution of tracer breakthrough into the validation drift to be predicted and these predictions also showed reasonable accuracy. The successful completion of this project demonstrates the feasibility of discrete fracture flow and tracer transport modelling. (36 refs.) (au).

1621 (STRIPA-TR–92-21) **Final report of the rock sealing project. Sealing of zones disturbed by blasting and stress release.** Boergesson, L. (Clay Technology AB, Lund (Sweden)); Pusch, R.; Fredriksson, A.; Hoekmark, H.; Karnland, O.; Sanden, T. Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden). Apr 1992. 156p. Order Number DE93603602. Source: OSTI; NTIS; INIS.

Test 2 and 3 of the rock sealing project comprised determination of the hydraulic properties of the disturbed rock around tunnels and drifts and the possibilities of decreasing the hydraulic conductivity of the disturbed zones by an attempt to seal the very fine excavation-induced fractures that cause an increase in conductivity. This report deals with the grouting procedures and their effect while the hydraulic testing before grouting is described in volume 2. The macro flow test of the BMT drift before grouting showed that the disturbed zone around the drift has a highly increased hydraulic conductivity reaching more than 1 m into the rock from the periphery of the drift. The most conductive shallow part of this zone was grouted by 350 1 m long 'hedgehog' holes. The holes were injected with cement using dynamic as well as static techniques. The injections were preceded by laboratory investigations of the rheological properties of different cement mixtures, by theoretical modelling of grout penetration in factures, and by full scale injections in an artificial fracture. The macro flow test was repeated after the grouting and the results evaluated by using the same finite element models as before the grouting. The conclusion was that the effect of the grouting was very small. Excavation of the rock after grouting showed that the grout penetration has been very poor into chlorite-coated fractures and a conclusion was that such fractures are hardly groutable due to debris hindering the grout from penetrating. (au).

1622 (STRIPA-TR–92-22) **Site characterization and validation - Final report.** Olsson, O. (ed.) (Conterra AB, Uppsala (Sweden)). Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden). Apr 1992. 412p. Order Number DE93603603. Source: OSTI; NTIS; INIS.

The central aims of the Site Characterization and Validation (SCV) project were to develop and apply; * an advanced site characterization methodology and * a methodology to validate the models used to describe groundwater flow and transport in fractured rock. The basic experiment within the SCV project was to predict the distribution of water flow and tracer transport through a volume of rock, before and after excavation of a sub-horizontal drift, and to compare these predictions with actual field measurements. A structured approach was developed to combine site characterization data into a geological and hydrogeological conceptual model of a site. The conceptual model was based on a binary description where the rock mass was divided into 'fracture zones' and 'averagely fractured rock'. This designation into categories was based on a Fracture Zone Index (FZI) derived from principal component analysis of single borehole data. The FZI was used to identify the location of fracture zones in the boreholes and the extent of the zones between the boreholes was obtained form remote sensing data (radar and seismics). The consistency of the geometric model thus defined, and its significance to the flow system, was verified by cross-hole hydraulic testing. The conceptual model of the SCV site contained three major and four minor fractures zones which were the principal hydraulic conduits at the site. The location and extent of the fracture zones were included explicitly in the flow and transport models. Four different numerical modelling approaches were pursued within the project; one porous medium approach, two discrete fracture approaches, and an equivalent discontinuum approach. A series of tracer tests was also included in the prediction-validation exercise. (120 refs.) (au).

1623 (STRIPA-TR–92-26) **The Stripa project annual report 1991.** Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden). May 1992. 192p. Order Number DE93603604. Source: OSTI; NTIS; INIS.

The Stripa project is an international project being performed under the sponsorship of the OECD Nuclear Energy Agency (NEA). The project concerns research related to the disposal of highly radioactive waste in crystalline rock. The Research and Development Division of the Swedish Nuclear Fuel and Waste Management Company (SKB) has been entrusted with the management of the project, under the direction of representatives from each participating country. The aim of this report is to inform the OECD Nuclear Energy Agency and the participants in the project about the general progress of work during 1991.

1624 (YMP-SELV–88/1990) **Methodology for detecting potentially contaminated soil sites: Preliminary study.** Assmuth, T. (National Board of Waters and the Environment, Helsinki (Finland)); Laeaeperi, O.; Strandberg, T.; Suokko, T. Ministry of the Environment, Helsinki (Finland). Environmental Protection Dept. 1990. 120p. (In Finnish). Order Number DE93711145. Source: OSTI; NTIS.

A preliminary study has been made of information sources and methods for the identification and assessment of chemically contaminated soil sites. A pilot survey of potential contaminated sites was carried out in three municipalities. The study includes an overview of the problems and activities within the field of contaminated soil sites in Finland and in some foreign countries. A short overview was presented of the methods applied in investigation and assessment of contaminated soil sites. On the basis of the preliminary survey, a rough evaluation was made of the magnitude and characteristics of the problems related to contaminated soil sites in Finland. Future needs in site inventories and investigations were outlined and recommendations were given for their conduct.

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Refer also to citation(s) 130, 225, 282, 283, 284, 296, 297, 360, 611, 757, 1137, 1489, 1490, 1494, 1504, 1509, 1510, 1511, 1513, 1515, 1516, 1517, 1518, 1519, 1520, 1521, 1522, 1523, 1524, 1527, 1528, 1539, 1542, 1543, 1568, 1588, 1589, 1590, 1591, 1663, 1669

1625 (BNL–47937) **Estimating phytoplankton photosynthesis by active fluorescence.** Falkowski, P.G.; Kolber, Z. Brookhaven National Lab., Upton, NY (United States). [1992]. 29p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-9204164–2: International symposium on the measurement of primary production from the molecular to global scale, La Rochelle (France), 19-26 Apr 1992). Order Number DE93000369. Source: OSTI; NTIS; GPO Dep.

Photosynthesis can be described by target theory, At low photon flux densities, photosynthesis is a linear function of irradiance (I), The number of reaction centers (n), their effective absorption capture cross section σ, and a quantum yield ϕ. As photosynthesis becomes increasingly light saturated, an increased fraction of reaction centers close. At light saturation the maximum photosynthetic rate is given as the product of the number of reaction centers (n) and their maximum electron transport rate ($1/\tau$). Using active fluorometry it is possible to measure non-destructively and in real time the fraction of open or closed reaction centers under ambient irradiance conditions in situ, as well as σ and $\phi\,\tau$ can be readily, calculated from knowledge of the light saturation parameter, I_k (which can be deduced by in situ by active fluorescence measurements) and σ. We built a pump and probe fluorometer, which is interfaced with a CTD. The instrument measures the fluorescence yield of a weak probe flash preceding (f_0) and succeeding (f_0) a saturating pump flash. Profiles of the these fluorescence yields are used to derive the instantaneous rate of gross photosynthesis in natural phytoplankton communities without any incubation. Correlations with short-term simulated in situ radiocarbon measurements are extremely high. The average slope between photosynthesis derived from fluorescence and that measured by radiocarbon is 1.15 and corresponds to the average photosynthetic quotient. The intercept is about 15% of the maximum radiocarbon uptake and corresponds to the average net community respiration. Profiles of photosynthesis and sections showing the variability in its composite parameters reveal a significant effect of nutrient availability on biomass specific rates of photosynthesis in the ocean.

1626 (BNL–47941) **Measurement of carbon and nitrogen biomass, and biovolume from naturally derived marine bacterioplankton.** Lee, SangHoon. Brookhaven National Lab., Upton, NY (United States). [1992]. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. Order Number DE93000371. Source: OSTI; NTIS; GPO Dep.

Bacterial production often needs to be presented in carbon or nitrogen biomass. Conversions to such universal units are particularly necessary to interpret the data in terms of energy or material flow in relation to other trophic groups of organisms. For field applications, bacterial biomass is routinely estimated from cell concentrations or cell volumes (biovolume) with appropriate conversion factors. For the direct determination of a conversion factor, in principle, three independent parameters are measured; number of cells, biovolume of the cells, and biomass. Current methods for all of those three are subject to potential errors. Described here is a method that combines the acridine orange (AO) direct count method for cell enumeration, AO epifluorescence photomicrography for the biovolume measurement, and CHN analysis for C and N biomass. This method offers several improvements including bacterial cells are derived from natural seawater and grown in unsupplemented natural seawater; corrections are made for the bacterial cells passing through glass fiber GF/F filters; and biovolume measurement is calibrated with fluorescent microspheres of known diameters.

1627 (CONF-9209228–1) **Size-dependent vulnerability of marine fish larvae to predation: An individual-based numerical experiment.** Cowan, J.H. Jr. (University of South Alabama, Mobile, AL (United States). Dept. of Marine Sciences); Houde, E.D.; Rose, K.A. Oak Ridge National Lab., TN (United States). [1992]. 17p. Sponsored by USDOE, Washington, DC (United States); Electric Power Research Inst., Palo Alto, CA (United States); National Science Foundation, Washington, DC (United States). DOE Contract AC05-84OR21400. Grant OCE-8701304;Contract RP2932-2. From 80. statutory meeting of the International Council for the Exploration of the Sea; Wassermunde (Germany); 24 Sep 1992. Order Number DE93000437. Source: OSTI; NTIS; INIS; GPO Dep.

An individual-based predation model permitted 20-d simulations to be initiated with populations of individual "theoretical" ctenophore-, medusae-, and planktivorous fish-like predators and larvae prey that varied in size, growth rate, and swimming speed

similarly to populations in the field. Results of predation experiments in 3.2 M^3 mesocosms were used to estimate parameters in a Gerritsen-Strickler type encounter model which is embedded into the individual-based framework. Larval susceptibility with size also was estimated for each predator. Model simulations indicate that the relationship between larval size and vulnerability to predation, and ultimately cohort survival rate, depends upon attributes both of individual predators and larval prey and that bigger or faster growing larvae within a cohort are not always most likely to survive. Despite the finding that cohort-specific mortality generally decreased as the mean size (length) of the members of the cohort increased, mean size or growth rate of individual surviving larvae each day was lower or not significantly different from those that died in most simulations until larvae reached a size threshold when susceptibility decreased more rapidly with larval size than encounter rate increased. After the size threshold was reached, a "switch" occurred whereby predation began to select for survivors of longer mean length. The time necessary to reach the threshold depends on growth rate of the larvae, size of the predators and the variance structure of these parameters.

1628 (DOE/BP–01830-12) **Supplementation in the Columbia Basin, Part 1: Rasp summary report series, background, description, performance measures, uncertainty, and theory.** USDOE Bonneville Power Administration, Portland, OR (United States). Div. of Fish and Wildlife. May 1992. 45p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE92040785. Source: OSTI; NTIS; GPO Dep.

This progress report broadly defines the scope of supplementation plans and activities in the Columbia Basin. It provides the foundation for more detailed analysis of supplementation in subsequent reports in this series. Topics included in this report are: definition of supplementation, project diversity, objectives and performance standards, uncertainties and theory. The supplementation theory will continue to evolve throughout the duration of Regional Assessment of Supplementation Project (RASP) and beyond. Supplementation is expected to be a major contributor to the planned increase in salmon and steelhead production in the Columbia Basin. The Fish and Wildlife Program of the Northwest Power Planning Council (NPPC) uses three approaches to protect and enhance salmon and steelhead in the Columbia Basin: (1) enhance fish production; (2) improve passage in the mainstream rivers; and (3) revise harvest management to support the rebuilding of fish runs (NPPC 1987). The fish production segment calls for a three-part approach focused on natural production, hatchery production, and supplementation. Supplementation is planned to provide over half of the total production increases.

1629 (DOE/BP/50301–3) **Biological manipulation of migration rate: The use of advanced photoperiod to accelerate smoltification in yearling chinook salmon, 1990: Annual report of research.** Muir, W.D.; Zaugg, W.S.; McCutcheon, S.; Williams, J.G. National Marine Fisheries Service, Seattle, WA (United States). Coastal Zone and Estuarine Studies Div. Jun 1992. 37p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AI79-88BP50301. Order Number DE92040929. Source: OSTI; NTIS; GPO Dep.

Research was conducted during 1990 to assess the feasibility of biologically manipulating physiological development and migratory behavior of yearling spring chinook salmon, Oncorhynchus tshawytscha. At Dworshak National Fish Hatchery, one treatment group was exposed to a 3-month advanced photoperiod schedule for 13 weeks preceding release to accelerate smolt development. Another group was exposed to the same advanced photoperiod schedule, but additionally was reared at an elevated water temperature (11.9°C) for 10 days prior to release. At Leavenworth National Fish Hatchery, a treatment group was exposed to a 3-month advanced photoperiod schedule for 17 weeks. Gill Na^+-K^+ATPase development and migratory performance were described for all groups. The treated fish which were the most physiologically advanced at release were detected in the highest proportions at collector dams and also migrated fastest downstream–similar to results obtained in 1988 and 1989.

1630 (DOE/ER/60628–3) **Utilization, cycling and vertical transport of particulate organic matter in the coastal marine environment: Final project report, November 15, 1987–May 14, 1992.** Landry, M.R. Hawaii Univ., Honolulu, HI (United States). Dept. of Oceanography. [1992]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-88ER60628. Order Number DE93000897. Source: OSTI; NTIS; GPO Dep.

This project was funded as part of the California Basin Study (CaBS), a DOE-funded regional program investigating production, cycling, transport, and fate of organic matter, chemical tracers, and pollutants in the Southern California Bight. The study area, adjacent to Los Angeles, was of programmatic interest due to its heavy concentration of energy-related activities, including offshore oil drilling and natural seeps, shipping, nuclear power facilities, and industrial and municipal ocean waste disposal. It was also of scientific interest because the wide continental margin in the region, pot-marked with natural sediment traps in the form of deep basins with restricted inputs and outputs, was ideal for integrating water-column and benthic studies and tracing the fates of in situ production and introduced pollutants. Our role in the CABS Program was to investigate the flux of particulate matter through the water column, emphasizing the relationship between macrozooplankton feeding and particle flux.

1631 (DOE/ER/60946–3) **Reductive mobilization of oxide-bound metals: Progress report, September 15, 1991–September 15, 1992.** Stone, A.T. Johns Hopkins Univ., Baltimore, MD (United States). Dept. of Geography and Environmental Engineering. [1992]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-90ER60946. Order Number DE93003159. Source: OSTI; NTIS; INIS; GPO Dep.

This project is concerned with the mobilization of MnO_2- and FeOOH-bound toxic metals in subsurface environments arising from an influx of natural organic matter or organic-containing wastes. Our work to date emphasizes the importance of characterizing the reductant, complexant, and adsorptive characteristics of constituent organic chemicals. Organic chemicals may interact with pollutant metals directly, or may bring about changes in speciation and solubility indirectly by acting upon MnO_2 and FeOOH host phases. The primary application of this work is the understanding of metal sorption and release processes within subsurface environments undergoing changes in redox status.

1632 (DOE/ER/61223–1) **Scientific development of a massively parallel ocean climate model: Progress report, 1991–1992.** Semtner, A.J. Jr. (Naval Postgraduate School, Monterey, CA (United States)); Chervin, R.M. Naval Postgraduate School, Monterey, CA (United States); National Center for Atmospheric Research, Boulder, CO (United States). [1992]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AI05-91ER61223. Order Number DE92040508. Source: OSTI; NTIS; GPO Dep.

A thorough examination was made of existing results from the global ocean model with high resolution. Additional experiments were chosen to help investigate the sensitivity of global ocean circulation and its associated transports of heat and salt to proposed changes in high-latitude buoyancy forcing and wind forcing.

1633 (DOE/ER/61224–1) **Scientific development of a massively parallel ocean climate model: Progress report for 1991–1992 and Continuing request, 1992–1993 to CHAMMP (Computer Hardware, Advanced Mathematics, Model Physics).** Semtner, A.J. Jr. (Naval Postgraduate School, Monterey, CA (United States)); Chervin, R.M. Naval Postgraduate School, Monterey, CA (United States); National Center for Atmospheric Research, Boulder, CO (United States). Mar 1992. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AI05-91ER61224. Order Number DE92040517. Source: OSTI; NTIS; GPO Dep.

Experiments to investigate the sensitivity of global ocean circulation and its associated transports of heat and salt to proposed changes in high-latitude buoyancy forcing and wind forcing. An experiment was designed to improve the representation of water-mass production in areas of known deep-water formation. At the same time, almost all of the deep and abyssal regions of the world

ocean were freed from earlier restoring to observed values of temperature and salinity. This convective forcing experiment has been run on the NCAR Y-MP/864 for three years of a planned five-year sensitivity study.

1634 (ETDE-IT–92-84) **Porto Tolle thermoelectric power station and aquatic environment of Po Delta (Italy): Synthesis of data.** Ambrogi, R. Ente Nazionale per l'Energia Elettrica, Milan (Italy). Centro Termica e Nucleare. 1990. 26p. (In Italian). Order Number DE93729445. Source: OSTI; NTIS (US Sales Only); INIS.

The 2400 MW, oil-fueled power station of Porto Tolle (Italy) potentially affects riverine, lagoon and marine sectors of the Po Delta. A synthesis is provided of the data gathered by several research lines, which studied different aspects of the environment during the pre-operational and operational period. Comparisons are made between the two periods and between stations more or less influenced by cooling water discharge. When river water is used for cooling (the majority of cases), some effects on water quality characteristics and on plankton community abundances are evident in the immediate vicinity of the outlet. In the lagoon (Sacca del Canarin) and in the stretch of sea in front of it, effects directly connected with the thermal effluent could not be detected. The geomorphological evolution of the lagoon, however, was influenced by the hydraulic modification brought about by the cooling circuit. This resulted in an enhancement of the biological production of the lagoon. The sea area is not affected in a significant way, but concern is raised about the interaction of cooling discharge and the eutrophic load from the Po River.

1635 (ETDE-IT–92-90) **Marine environment indicators and indices: Use of macrobenthos.** Ambrogi, R.; Occhipinti Ambrogi, A. Ente Nazionale per l'Energia Elettrica, Milan (Italy). Centro Termica e Nucleare; Pavia Univ. (Italy). Ist. di Genetica. 1991. 44p. (In Italian). Order Number DE93729478. Source: OSTI; NTIS (US Sales Only); INIS.

In marine environmental impact studies the macrobenthos can be used successfully in order to establish indicators and indices and to construct environmental quality functions. The body of knowledge gathered on Mediterranean benthic communities is used to emphasize the role of 'characteristic' species in describing well defined environmental conditions. The structural indices, even the simplest and commonest ones, can give a first insight of the disturbance intensity. In particular, indices based on species, abundance and biomass curves are described, in addition to those based on the log-normal distribution of individuals among species and those derived from the method of abundance-biomass comparison.

1636 (FEMP/SUB–055) **Electrofishing survey of the Great Miami River, September 1991: Annual report.** Miller, M.C. (Cincinnati Univ., OH (United States). Dept. of Biological Sciences); Ross, L.S.; Bixby, R.; Engman, J.; Gutierrez, F.; Perry, W. Westinghouse Environmental Management Co. of Ohio, Cincinnati, OH (United States). Fernald Environmental Management Project; Cincinnati Univ., OH (United States). Dept. of Biological Sciences. Aug 1992. 58p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-86OR21600. Order Number DE93001261. Source: OSTI; NTIS; INIS; GPO Dep.

This 1991 report is a continuation to our report on the status of the fishery of the Great Miami River in September 1990. The fisheries analysis contained in this report focuses on the areas that are upstream of the Fernald Environmental Management Project (FEMP) outfall line, and those sites downstream of the outfall potentially impacted by FEMP effluents. Fish were collected by electroshocking. The fish were identified to species, weighed, measured; their gender was determined and external abnormalities are noted. Modified filets and remaining parts are frozen for shipment to the specified lab.

1637 (INIS-GB–446) **Annual report on radioactive discharges from Winfrith and monitoring the environment 1990.** AEA Technology, Winfrith (United Kingdom). Jun 1991. 56p. Order Number DE93605434. Source: OSTI; NTIS (US Sales Only); INIS.

This annual report, the sixth of its type, aims to provide full information on discharges and environmental monitoring. The report is mainly graphical, comparing past and current levels with authorised limits, derived limits or the recommended limits of the International Commission on Radiological Protection (ICRP). All the data are presented at the end of the report in tabular form. Discharges from Winfrith are subject to Authorisations issued jointly by the Department of the Environment (DOE) and the Ministry of Agriculture, Fisheries and Food (MAFF). The numerical values of the Authorised Limits are based on past performance, future requirements and the application of Best Practicable Means (BPM). As a "back stop", discharges at the limits must not result in doses to the most potentially exposed part of the local population - the critical group - exceeding 0.5 mSv per year. The limit recommended by the International Commission on Radiological Protection (ICRP) for dose to a member of the general public is 1.0 mSv per year. In September 1990 Winfrith's Steam Generating Heavy Water Reactor (SGHWR) was shut down and a decision taken, later, that reactor operation would cease. The pattern of discharges thus changed in the last quarter of the year and discharges in future will be lower, and of a different pattern, than those of the past twenty years. The dose to the critical group, which is already less than 2% of the ICRP limit and less than 1% of the UK average natural background dose will drop further in future years. (Author).

1638 (INIS-mf–13371) **IOC-UNEP review meeting on oceanographic processes of transport and distribution of pollutants in the sea.** IOC workshop report. United Nations Educational, Scientific and Cultural Organization (UNESCO), 75 - Paris (France). Intergovernmental Oceanographic Commission (IOC). 1991. 29p. (CONF-9105381–: IOC-United Nations Environment Programme (UNEP) review meeting on oceanographic processes of transport and distribution of pollutants in the sea, Zagreb (Yugoslavia), 15 May 1991). Order Number DE93605070. Source: OSTI; NTIS (US Sales Only); INIS.

The IOC-UNEP Review Meeting on Oceanographic Processes of Transfer and Distribution of Pollutants in the Sea was opened at the Ruder Boskovic Institute, Zagreb, Yugoslavia on Monday, 15 May 1989. Papers presented at the meeting dealt with physical and geochemical processes in sea-water and sediment in transport mixing and dispersal of pollutants. The importance of mesoscale eddies and gyres in the open sea, wind-driven currents and upwelling events in the coastal zone, and thermohaline processes in semi-enclosed bays and estuaries was recognized. There is strong evidence that non-local forcing can drive circulation in the coastal area. Concentrations, horizontal and vertical distributions and transport of pollutants were investigated and presented for a number of coastal areas. Riverine and atmospheric inputs of different pollutants to the western Mediterranean were discussed. Reports on two on-going nationally/internationally co-ordinated projects (MEDMODEL, EROS 2000) were presented. Discussions during the meeting enabled an exchange of ideas between specialists in different disciplines to be made. It is expected that this will promote the future interdisciplinary approach in this field. The meeting recognized the importance of physical oceanographic studies in investigating the transfer and distribution of pollutants in the sea and in view of the importance of the interdisciplinary approach and bilateral and/or multilateral co-operation a number of recommendations were adopted.

1639 (INIS-mf–13371, pp. 16) **River versus atmospheric inputs to the Western Mediterranean: Annex 3.** Martin, J.M. United Nations Educational, Scientific and Cultural Organization (UNESCO), 75 - Paris (France). Intergovernmental Oceanographic Commission (IOC). 1991. (CONF-9105381–: IOC-UNEP review meeting on oceanographic processes of transport and distribution of pollutants in the sea, Zagreb (Yugoslavia), 15 May 1991). In *IOC-UNEP review meeting on oceanographic processes of transport and distribution of pollutants in the sea.* 29p. Order Number DE93605070. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. AMERICIUM 241/mediterranean sea; CESIUM 137/mediterranean sea; PLUTONIUM 238/mediterranean sea; PLUTONIUM 239/mediterranean sea; PLUTONIUM 240/mediterranean sea; ATMOSPHERIC PRECIPITATIONS; CADMIUM; COPPER; LEAD; RADIONUCLIDE MIGRATION

1640 (KFK-PWAB–9) **Test field water/soil. Sub-project II: Pollutant transport in underground strata, methods of detection and monitoring. 1. Project phase. Final report.** Hofmann, B. (Stuttgart Univ. (Germany). Inst fuer Wasserbau); Kobus, H.; Ptak,

T.; Schad, H.; Teutsch, G. Kernforschungszentrum Karlsruhe GmbH (Germany). Projekt Wasser-Abfall-Boden (PWAB). Oct 1991. 128p. (In German). Order Number DE93720173. Source: OSTI; NTIS (US Sales Only).

This research report contains the results of the first project phase (1.7.87 - 28.2.91) of the subproject of the Institute for Hydraulic Engineering. Chapter 2 gives an overview of the research programme. Chapters 3 and 4 explain the test field infrastructure and the measuring systems (laboratory and field measuring equipment) specially designed for it. Measuring methods, results and first evaluations are summarized in chapter 5. Further analysis of data with geostatic methods and the subsequent stochastic numerical simulation of groundwater flow- and transport processes are described in chapters 6 and 7. (orig.).

1641 (NKS-RAD–2-91-2) **Algae as bioindicators for radionuclides in Nordic coastal waters: Summary of discussions and abstracts of papers.** Neumann, G. (Swedish Environmental Protection Agency (Sweden)); Notter, M. Nordisk Kernesikkerhedsforskning, Roskilde (Denmark). 1991. 27p. (CONF-9010509–: Seminar on algae as bioindicators for radionuclides in Nordic coastal waters, Forsmark (Sweden), 16 Oct 1990). Order Number DE93605435. Source: OSTI; NTIS; INIS.

During the later part of the 1970's NKS decided to introduce the bladder wrack (Fucus vesiculosus) as a suitable organism for monitoring radionuclides in Nordic coastal waters. During the past few years studies on this subject have been going on to a varying extent in the different Nordic countries. At this miniseminar the participants described different ongoing studies and projects. The lectures are summarized in the abstracts in the appendix, in which the speakers themselves are responsible for their contributions. (au).

1642 (RFP–4553) **Remote surface water monitoring.** Baxter, D.; Goodwin, W. EG and G Rocky Flats, Inc., Golden, CO (United States). [1992]. 28p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC34-90DP62349. (CONF-9209203–1: Environmental professionals meeting, Park City, UT (United States), 9-11 Sep 1992). Order Number DE92040779. Source: OSTI; NTIS; INIS; GPO Dep.

The Surface Water Division (SWD) and the Environmental Technologies Group (ET) have teamed up to create a complete remote surface water monitoring system based on new technologies in microelectronics and the environmental sciences. Careful evaluation of these new technologies has resulted in the design and installation of a working system that is easily installed, cost-effective and reliable. Rocky Flats Plant (RFP) is part of the Department of Energy weapons complex. Because of its location upstream of the Denver, Colorado, Metropolitan area, the plant is required by law and interagency agreements to adhere to strict specifications for surface water monitoring and discharge, including the requirement for utilization of best available technology. RFP now has a successful remote surface water monitoring system. This system was developed by a team of result-oriented people with strong electronics backgrounds and many years of experience in instrumentation, microprocessors, and the environmental sciences. Even after implementation of the system, the team continues to seek out and test components that fit into the system and that also meet or exceed the strict system requirements. The systematic approach used in development made it possible to exceed regulatory requirements while maintaining accurate field data.

1643 (SA-PUB–9/89-Vol.1, pp. 51-62) **Variations of the sea temperature around the coasts of Finland.** Alenius, P. (Finnish Institute of Marine Research, Helsinki (Finland)). Academy of Finland, Helsinki (Finland). 1989. (CONF-8909491–Vol.1: Conference on climate and water, Helsinki (Finland), 11-15 Sep 1989). In *Conference on climate and water: Volume 1.* 520p. Order Number DE93721620. Source: OSTI; NTIS.

Considerable interest in the variability of temperature and salinity in the Baltic Sea has been shown during this decade. Studies of seasonal and long term variations of temperature and salinity near the Finnish coasts has been published. Those studies have used time series from hydrographic stations available since early 1900's. This study continues those studies. The variations in the seasonal temperature cycle as well as variations in the thermal stratification are studied. The character of the changes between different decades of this century are described. Also the trends in temperature and ice conditions are compared.

1644 (SA-PUB–9/89-Vol.1, pp. 63-72) **On climatic variations of the baltic sea ice conditions.** Leppaeranta, M. (Finnish Institute of Marine Research, Helsinki (Finland)). Academy of Finland, Helsinki (Finland). 1989. (CONF-8909491–: Conference on climate and water, Helsinki (Finland), 11-15 Sep 1989). In *Conference on climate and water: Volume 1.* 520p. Order Number DE93721620. Source: OSTI; NTIS.

The Baltic Sea is located in the seasonal sea ice zone of the world ocean where climatic variations show up drastically in the characteristics of ice seasons. The freezing and break-up dates range 2-3 months in a fixed location. The paper presents results of a time series analysis of Baltic Sea ice observations. The length of the time series is 70-156 years, and they describe the freezing and break-up dates and ice thickness along the Finnish coast. A slight general trend towards milder ice seasons is present. A first order analytic analysis is carried through to see how the ice season characteristics depend on the course of the air temperature. The results are further used to examine the climatic warming effect to the Baltic Sea ice season.

1645 (SA-PUB–9/89-Vol.1, pp. 121-137) **The Mediterranean oscillation: impact on precipitation and hydrology in Italy.** Conte, M. (Servizio Meteorologico dell Aeronautica, Rome (Italy)); Giuffrida, A.; Tedesco, S. Academy of Finland, Helsinki (Finland). 1989. (CONF-8909491–Vol.1: Conference on climate and water, Helsinki (Finland), 11-15 Sep 1989). In *Conference on climate and water: Volume 1.* 520p. Order Number DE93721620. Source: OSTI; NTIS.

An analysis is carried out of the 500 hPa height over the Mediterranean since 1946 by using, as guide stations, Alger and Cairo, representative sites, respectively, of the western basin and of the eastern one. Such analysis is mainly performed on the annual values. High positive correlation coefficients are found out among the 500 hPa heights of Alger and the ones of other sites in the central and western Mediterranean; on the contrary, negative correlation coefficients are pointed out among the values of Alger and the corresponding ones of localities of the eastern Mediterranean, in particular Cairo. An oscillatory increase of the 500 hPa height at Alger is quite evident from the analysis, in exact phase-opposition with an oscillatory decrease of the height at Cairo.

1646 (SA-PUB–9/89-Vol.1, pp. 138-148) **Effect of climate change on evaporation and water temperature.** Jurak, D. (Institute of Meteorology and Water Management, Warsaw (Poland)). Academy of Finland, Helsinki (Finland). 1989. (CONF-8909491–Vol.1: Conference on climate and water, Helsinki (Finland), 11-15 Sep 1989). In *Conference on climate and water: Volume 1.* 520p. Order Number DE93721620. Source: OSTI; NTIS.

A methodology for the assessment of climate impacts on shallow (non-stratified) aquatic bodies is presented. The model is aimed to calculate the water temperature, heat exchange characteristics and evaporation losses using standard meteorological data. It was extensively tested for the present climate conditions and used for calculating thermal regime and free-water evaporation for a number of lakes and reservoirs in Poland. Assuming GCMs-based changes of climatic parameters under the hypothesis of CO_2 doubling, calculations of T and E were done for three locations in Poland with differentiated climatic conditions. The results show that for the mid-altitude regions the mean monthly temperature of water may rise from 0.9 deg C to 1.5 deg C, depending on the month. Evaporation values will increase from 14 % to 19 %. CO_2 doubling may greatly influence the seasonal distribution of energy and water balance of water bodies, and consequently change their physical, biological and chemical properties.

1647 (SA-PUB–9/89-Vol.2, pp. 7-27) **The impact of climatic change on the aquatic environment.** Beran, M. (Institute of Hydrology, Wallingford (GB)). Academy of Finland, Helsinki (Finland). 1989. (CONF-8909491–Vol.2: Conference on climate and water, Helsinki (Finland), 11-15 Sep 1989). In *Conference on climate and water: Volume 2.* 393p. Order Number DE93721621. Source: OSTI; NTIS.

The paper is a survey of methods for integrating the immediate effects of climatic change on hydrological variables to consider the impact on the physical, chemical and biological properties of water bodies; and consequences to water supply, waste disposal, human health, and the viability of aquatic ecosystems. Aquatic environments that are considered include rivers and lakes, bogs, marshes, tundra and deltas and their responses to changes in climate and carbon dioxide. Related practical problems are considered in the field of fisheries, water pollution, conservation, and human diseases. By contrast with quantitative aspects of hydrology and water resources, few authors have attempted to evaluate the impact of climatic change on qualitative aspects. The prime objects of this paper are therefore to review information sources on climate sensitivity in the aquatic environment, and to encourage relevant impact and other studies by experts in water quality and aquatic ecology.

1648 (SA-PUB–9/89-Vol.2, pp. 28-36) **The impact of precipitation variability on the quality of running waters.** Simeonidis, A. (Uppsala Univ. (Sweden). Div. of Hydrology). Academy of Finland, Helsinki (Finland). 1989. (CONF-8909491–Vol.2: Conference on climate and water, Helsinki (Finland), 11-15 Sep 1989). In *Conference on climate and water: Volume 2.* 393p. Order Number DE93721621. Source: OSTI; NTIS.

Physico-chemical data obtained for the period 1965-1986 have been used to investigate time variations of substance transports in the river Fyris within Uppsala County, Sweden. Substance transports have been calculated for the elements of phosphorous, nitrogen and organic matter measured as COD-Mn. The yearly substance transport series shows a significant change about the year 1976. After this year the transport increases for all three elements having decreased since 1967. The substance transport series well follows the precipitation variability as shown in the yearly precipitation sums. The precipitation data were from a station within the river Fyris drainage basin. Further, average yearly concentrations were investigated for each element. Nitrogen concentrations increased steadily until 1976 while phosphorous and COD-Mn decreased during the same period. After this year changes in concentrations were only moderate. It is concluded that the increase of the elements after 1976 is due to increase in precipitation amounts.

1649 (SA-PUB–9/89-Vol.2, pp. 68-78) **Vegetation, water and climatic change.** Mandych, A.F. (Institute of Geography, Moscow (USSR). Dept. of Methodology of Geosystems Study). Academy of Finland, Helsinki (Finland). 1989. (CONF-8909491–Vol.2: Conference on climate and water, Helsinki (Finland), 11-15 Sep 1989). In *Conference on climate and water: Volume 2.* 393p. Order Number DE93721621. Source: OSTI; NTIS.

With climatic change, transformation of the vegetation cover will not be only due to increase or decrease of bioclimatic temperatures but probably due to alternation of water behaviour and soil erosion rate. This can lead to drastic changes the bases of present vegetation existence.

1650 (SA-PUB–9/89-Vol.2, pp. 43-67) **Climate induced hydrological shifts in Europe and their implication spectrum - unique opportunity to strengthen hydrology.** Falkenmark, M. (Natural Science Research Council, Stockholm (Sweden)). Academy of Finland, Helsinki (Finland). 1989. (CONF-8909491–Vol.2: Conference on climate and water, Helsinki (Finland), 11-15 Sep 1989). In *Conference on climate and water: Volume 2.* 393p. Order Number DE93721621. Source: OSTI; NTIS.

Climate change will be felt by society first through water-related phenomena. The wettening of European land may change considerably with wetter conditions in the North and drier in the South. Considerable growing period shifts may perturbate European agricultural patterns, increasing the growing season in the North but creating drought problems in the South. Water availability may grow scarce in the South, causing large water management problems when higher demand from agriculture has to be met under increased water stress. Climate change implications for well-organized European societies should not be underestimated. Most sectors of society will feel changes, and have to meet increasing costs for adaptation measures. The result may include an all-time-high in the demand for hydrological consultancy. Timely policy responses will be crucial for adaptation/mitigation but will depend on the development of improved ways of communication between scientists and policy-makers. The organization of policy workshops, and the use of matrices to transfer messages on interdependent phenomena might be useful components. The considerable implications of the climate change, propagated through the water cycle, will create large research needs, particularly on the interaction water-soil-vegetation, water quality genesis changes, influence of hydrological shifts on land use, methods for early warning by use of hydrological indicator systems, and assessment of expected changes in the hydrology and freshwater exchange of the Baltic with secondary consequences on the marine biology of the system. Climate change will provide a unique opportunity to strengthen and renew hydrology, defending its position as one of the major geosciences.

1651 (SA-PUB–9/89-Vol.2, pp. 100-113) **Non-point source pollution from irrigated watersheds: An assessment and management with regard to climatic changes.** Belyaeva, T. (Water Problems Institute of the USSR Academy of Sciences, Moscow (USSR)). Academy of Finland, Helsinki (Finland). 1989. (CONF-8909491–Vol.2: Conference on climate and water, Helsinki (Finland), 11-15 Sep 1989). In *Conference on climate and water: Volume 2.* 393p. Order Number DE93721621. Source: OSTI; NTIS.

An assessment of irrigation impacts on water quality with regard to alternative economic development strategies is considered as a part of a general problem of regional water and land resources management under changing climate. The assessment of irrigation pollution consists of several stages: an assessment of unit loads of pollutants from agricultural watersheds according to land use type taking into account varied levels of precipitation, evapotranspiration and runoff under considered climatic scenarios; an assessment of total pollutant export from a basin for various climatic scenarios and economic development strategies implementing optimization modelling technique for land and water resources allocation in agricultural sector; conservation management of water and land sources use and pollution control according to established environmental constraints. The final stage is an iterative process aimed at reaching established water quality standards by means of land and water resources reallocation, technological shifts in crop production and irrigation methods. A comparative analysis of various strategies of economic development in an irrigated region (the Northern Caucasus area of the European USSR is used for a case study) helps to select the optimal ways of production, technological and environmental targets achievement with regard to future global and regional climatic changes.

1652 (SA-PUB–9/89-Vol.2, pp. 114-127) **Impacts of climatic changes on hydrology and water resources of coastal zones.** Volker, A. (IHP- National Committee, Westlaan (Netherlands)). Academy of Finland, Helsinki (Finland). 1989. (CONF-8909491–Vol.2: Conference on climate and water, Helsinki (Finland), 11-15 Sep 1989). In *Conference on climate and water: Volume 2.* 393p. Order Number DE93721621. Source: OSTI; NTIS.

The present notes are dealing with the impacts of climatic changes on the hydrology and water resources of coastal zones. Emphasis will be on deltaic and other low-lying coastal areas such as lagoon areas and coastal marshes. Attention will be focused on Europe with landscapes in mind like the deltas of the Vistule (Poland), the Rhine and Meuse (Netherlands), the Ebro (Spain), the Rhone (France), the Danube (Romania) and low-lying coastal areas of Denmark, east-coast of England, north-western coast of Federal Germany, west-coast of France.

1653 (SA-PUB–9/89-Vol.2, pp. 128-147) **Impact of sea level rise on coastal zone management in Southern Sweden.** Lindh, G. (Lund Univ. (Sweden). Dept. of Water Resources Engineering); Hanson, H.; Larson, M. Academy of Finland, Helsinki (Finland). 1989. (CONF-8909491–Vol.2: Conference on climate and water, Helsinki (Finland), 11-15 Sep 1989). In *Conference on climate and water: Volume 2.* 393p. Order Number DE93721621. Source: OSTI; NTIS.

One consequence of the greenhouse effect is sea level rise. It is expected that this phenomenon will increase erosion along coastal reaches used for recreation as well as increase saltwater intrusion affecting water supply from wells located near the coast. These two

problems may in the long run create a renewed attitude to long-term planning, development, and decision-making both on a local and regional level. In this paper the problems of beach erosion and saltwater intrusion caused by sea level rise is discussed for regions in southern Sweden. Remedial measures in order to meet an increased erosion are presented and their ability to function during an increase in water level is examined. It is difficult to give recommendations about the most appropriate method to be used, since the consequences of the greenhouse effect will appear gradually at a rather slow rate. However, the main object of the paper is to create an awareness among people involved in coastal zone planning and management of coming climatic changes and its possible impacts.

1654 (SA-PUB–9/89-Vol.2, pp. 148-160) **The impact of climate change on coastal zone management in Britain: A preliminary analysis.** Coker, A.M. (Middlesex Polytechnic Flood Hazard Research Centre, Enfield (GB)); Thompson, P.M.; Penning-Rowsell, E.C.; Smith, D.I. Academy of Finland, Helsinki (Finland). 1989. (CONF-8909491–Vol.2: Conference on climate and water, Helsinki (Finland), 11-15 Sep 1989). In *Conference on climate and water: Volume 2.* 393p. Order Number DE93721621. Source: OSTI; NTIS.

The impact of climate change on coastal zone resources and management in Britain could be profound. Recent research and analysis indicates that the extent of areas affected could be substantial, although the uncertainty in these predictions remains large. This paper reviews the latest of these predictions and gives an assessment of the extent of the consequential 'threat' from sea level rise. In addition it evaluates a number of the impacts from such a sea level rise, including the effect on storm surge heights and on the warnings of flooding and erosion losses that would ensue. A number of examples are used to evaluate the variety, extent and degree of many of the possible socio-economic and environmental impacts, and a methodology for assessing the economic impacts in more detail is outlined, based on previous research on flooding and erosion impacts. Finally some conclusions are drawn about the possible policy implications of the sea level rise phenomenon and its likely impacts.

1655 (SA-PUB–9/89-Vol.2, pp. 161-176) **The impacts of climate variability and change on urban and industrial water supply and waste water disposal.** Kaczmarek, Z. (International Institute for Applied Systems Analysis, Laxenburg (Austria)); Kindler, J. Academy of Finland, Helsinki (Finland). 1989. (CONF-8909491–Vol.2: Conference on climate and water, Helsinki (Finland), 11-15 Sep 1989). In *Conference on climate and water: Volume 2.* 393p. Order Number DE93721621. Source: OSTI; NTIS.

The paper concentrates on the assessment of possible consequences of present and future climate variability of climatic characteristics on urban water supply and demand. The stability of climate and hydrology is up to now a central concept in water resources planning and decisions are being made on the assumption that future water supply will be much like the past. Since the mid-seventies scientists and - unfortunately - to a lesser extent decision makers have agreed that this is no longer a good assumption. Water managers have to use the new hydrologic estimates to evaluate the performance of water resource systems under changing climatic conditions. In spite of still existing uncertainties in climate predictions there is a need for new approaches to water resources planning to make supply systems more resilient and robust.

1656 (SA-PUB–9/89-Vol.2, pp. 177-190) **Identifying the climate-sensitive segment of British reservoir yield.** Law, F.M. (Institute of Hydrology, Wallingford (GB). Engineering Hydrology Division). Academy of Finland, Helsinki (Finland). 1989. (CONF-8909491–Vol.2: Conference on climate and water, Helsinki (Finland), 11-15 Sep 1989). In *Conference on climate and water: Volume 2.* 393p. Order Number DE93721621. Source: OSTI; NTIS.

The role of a reservoir is to balance flows over a drought period using storage to cover cumulative deficits in meeting demand. Those flows originate from both prior climate as baseflow and from current climate as rapid response runoff. Recognising the relative contribution of each segment of yield gives a fundamental understanding that can be used to determine the scope that climate change has to vary yield. The paper summarises the historical development of the dominant UK water supply yield estimation method which concentrates on the total drought flow that can be relied on for a chosen level of risk (normally the once-in-fifty year event). Results from such analyses are best compared using dimensionless yield-storage 'curves' and noting on them the critical drought durations that have determined each straight line sector of those curves.

1657 (SA-PUB–9/89-Vol.2, pp. 191-206) **Impact of greenhouse effect on sewerage systems.** Nirczynowicz, J. (Lund Univ. (Sweden). Dept. of Water Resources Engineering). Academy of Finland, Helsinki (Finland). 1989. (CONF-8909491–Vol.2: Conference on climate and water, Helsinki (Finland), 11-15 Sep 1989). In *Conference on climate and water: Volume 2.* 393p. Order Number DE93721621. Source: OSTI; NTIS.

The possible impacts of modification in rainfall pattern due to greenhouse effect on the function of the sewerage system is studied based on a case study of the city of Lund and Malmoe. The Storm Water Management Model is used to simulate changes in runoff pattern. The paper lists possible effects of increase in rainfall intensity on the urban water cycle, quantifies changes in runoff pattern and discusses significance of detected changes in terms of economical and environmental consequences and the possibilities to undertake preventative measures. For the purpose of the present study, the 10 %, 20 % and 30 % levels of rainfall increase was assumed. Given examples of possible impacts of the greenhouse effect on the function of the sewage system, in spite of considerable uncertainty regarding the potential future rate of hydrological changes, bear witness to the grate vulnerability of sewerage systems to results of climate changes.

1658 (SA-PUB–9/89-Vol.2, pp. 237-244) **Effects of climate variation of public water supply.** Goma, W. (Central Forecast Office, Lusaka (Zambia). Dept. of Meteorology). Academy of Finland, Helsinki (Finland). 1989. (CONF-8909491–Vol.2: Conference on climate and water, Helsinki (Finland), 11-15 Sep 1989). In *Conference on climate and water: Volume 2.* 393p. Order Number DE93721621. Source: OSTI; NTIS.

The paper looks at climate variation over the last 50 years period from 1937 - 1988. Also, is to search for similar pattern in weather fluctuation. Secondly, is to access if there has been any effect of climate variation on public water supply in Zambia.

1659 (SKB-TR–91-57) **The groundwater circulation in the Finnsjoe area - the impact of density gradients. Part A, B, C.** Ahlbom, K. (Conterra AB, Uppsala (Sweden)); Svensson, U. Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden). Nov 1991. 83p. Order Number DE93605444. Source: OSTI; NTIS; INIS.

Saline groundwater is found in many boreholes at the Finnsjoen site. The occurrences and depths to the saline water vary however greatly between different boreholes. This report presents a conceptual model which can explain most of these differences. The model is based on several assumptions. The background and relevance for using these assumptions are discussed and estimated depths to the interface between non-saline and saline groundwater, based on the conceptual model, are presented. (au).

1660 (SKB-TR–92-05) **Buoyancy flow in fractured rock with a salt gradient in the groundwater - An initial study.** Claesson, J. (Lund Univ., Dept. of Building Physics (Sweden)). Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden). Feb 1992. 76p. Order Number DE93603615. Source: OSTI; NTIS; INIS.

Nuclear waste, deposited in canisters in rock, produces heat that will induce a buoyancy flow of groundwater in fractures. The radioactive material may then, in case of leakage, possibly reach the biosphere. The groundwater density will increase downwards with an increasing salt content. This density increase counteracts the thermal buoyancy, and it may create a natural barrier for the repository. The aim of the study is to analyse this barrier effect and to assess the extent of upward flow. The coupled flow process for groundwater, salt and heat is studied. The equations have been analysed in great detail, and a numerical model has been developed for the case of groundwater flow in a fracture or crack plane.

The largest upward motion from the repository has been determined with the model for a wide range of heat release. Approximate formulas, which are shown to be sufficiently accurate for assessments, have been derived. There is a very clear barrier effect. In a reference case with a salt concentration increase of 2% per km downwards, and with as much as 300 canisters (releasing all in all 0.32 TWh) placed in a limited region, the largest upward movement of groundwater from the repository region became 150 m. The results is remarkably insensitive to variations of the involved parameters (heat release, distance from canisters to fracture plane, considered time, salt concentration gradient, thermal expansivity, hydraulic conductivity of flow plane and so on). (au).

1661 (SKB-TR--92-10) **Description of groundwater chemical data in the SKB database GEOTAB prior to 1990.** Laurent, S. (IVL, Stockholm (Sweden)); Magnusson, S.; Nilsson, A.C. Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden). Apr 1992. 52p. Order Number DE93603616. Source: OSTI; NTIS; INIS.

Groundwater chemical investigations are one of the research areas in SKBs research and development program for the final disposal of spent nuclear fuel. Since 1985 a specially designed integrated system consisting of a mobile field laboratory and a down-hole measuring probe is used for the chemical characterization of deep groundwater. The groundwater chemical analyses are performed in the field laboratory and E_h and pH are measured in situ by the down-hole probe. The chemical data obtained from the specific site investigations are stored in the GEOTAB database on the VAX computer at SKB. The description of chemical data handling given in this paper concerns the period after 1985. (au).

1662 (WSRC-RP--91-1213) **Biological monitoring of Upper Three Runs Creek, Savannah River Site, Aiken County, South Carolina, March 1990--July 1991.** Westinghouse Savannah River Co., Aiken, SC (United States); Chem-Nuclear Lab. Services, Inc., Greenville, SC (United States). Dec 1991. 197p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE93000638. Source: OSTI; NTIS; GPO Dep.

In anticipation of the fall 1988 start up of effluent discharges into Upper Three Runs Creek by the F/H Area Effluent Treatment Facility of the Savannah River Site, Aiken, SC, a two and one half year biological study was initiated in June 1987. Upper Three Runs Creek is an intensively studied fourth order stream known for its high species richness. Designed to assess the potential impact of F/H area effluent on the creek, the study included qualitative and quantitative macroinvertebrate stream surveys at five sites (see map), chronic toxicity testing of the effluent, water chemistry and bioaccumulation analysis. In a March 1990 study of the potential impact of F/H Area effluent on the macroinvertebrate communities of Upper Three Runs Creek was extended, with reductions in the number of sites to be sampled and in the frequency of water chemistry sampling. This report presents the results of macroinvertebrate stream surveys at three sites, chronic toxicity testing of the effluent and water chemistry analysis of the three stream sites and the effluent from March 1990 to July 1991.

55 BIOMEDICAL SCIENCES, BASIC STUDIES

1663 (LBL-PUB--701) **Mathematics and biology: The interface, challenges and opportunities.** Levin, S.A. (ed.) (Cornell Univ., Ithaca, NY (United States)). Lawrence Berkeley Lab., CA (United States). Jun 1992. 96p. Sponsored by USDOE, Washington, DC (United States); National Science Foundation, Washington, DC (United States). DOE Contract AC03-76SF00098. Grant DMS-89-10353. (CONF-9004365--Summ.: National Science Foundation (NSF) workshop on mathematics and biology, Washington, DC (United States), 28 Apr - 3 may 1990). Order Number DE92041207. Source: OSTI; NTIS; INIS; GPO Dep.

The interface between mathematics and biology has long been a rich area of research, with mutual benefit to each supporting discipline. Traditional areas of investigation, such as population genetics, ecology, neurobiology, and 3-D reconstructions, have flourished, despite a rather meager environment for the funding of such work. In the past twenty years, the kind and scope of such interactions between mathematicians and biologists have changed dramatically, reaching out to encompass areas of both biology and mathematics that previously had not benefited. At the same time, with the closer integration of theory and experiment, and the increased reliance on high-speed computation, the costs of such research grew, though not the opportunities for funding. The perception became reinforced, both within the research community and at funding agencies, that although these interactions were expanding, they were not doing so at the rate necessary to meet the opportunities and needs. A workshop was held in Washington, DC, between April 28 and May 3, 1990 which drew together a broadly based group of researchers to synthesize conclusions from a group of working papers and extended discussions. The result is the report presented here, which we hope will provide a guide and stimulus to research in mathematical and computational biology for at least the next decade. The report identifies a number of grand challenges, representing a broad consensus among the participants.

5501 Behavioral Biology

Refer also to citation(s) 1769

5502 Biochemistry

Refer also to citation(s) 100, 322, 327, 328, 1131, 1182, 1663, 1670, 1671, 1672, 1674, 1733, 1762, 1763, 1764

1664 (BNL--47940) **Evaluating bacterial activity from cell-specific ribosomal RNA content measured with oligonucleotide probes.** Kemp, P.F.; Lee, S.; LaRoche, J. Brookhaven National Lab., Upton, NY (United States). [1992]. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. Order Number DE93000370. Source: OSTI; NTIS; GPO Dep.

We describe a procedure for measuring the cell-specific quantity of ribosomal RNA (rRNA) and DNA in order to evaluate the frequency distribution of activity among cells. The procedure is inherently quantitative, does not require sample incubation and potentially can be taxon-specific. Fluorescently-labelled oligonucleotide probes are hybridized to the complementary 16S rRNA sequences in preserved, intact cells. The resulting cell fluorescence is proportional to cellular rRNA content and can be measured with a microscope-mounted photometer system, by image analysis, or by flow cytometry. Similarly, DNA content is measured as fluorescence of cells stained with the DNA specific fluorochrome DAPI. These are either prepared as separate samples for purposes of enumeration and DNA measurements, or are dual-labelled cells which are also hybridized with oligonucleotide probes.

1665 (DOE/ER/60673--T5) **Neutron scatter studies of chromatin structures related to functions: Technical progress report, November 1, 1991--May 15, 1992.** Bradbury, E.M. California Univ., Davis, CA (United States). [1992]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG03-88ER60673. Order Number DE93002520. Source: OSTI; NTIS; INIS; GPO Dep.

Despite of setbacks in the lack of neutrons for the proposed We have made considerable progress in chromatin reconstitution with the VLR histone H1/H5 and in understanding the dynamics of nucleosomes. A ferromagnetic fluid was developed to align biological molecules for structural studies using small-angle-neutron-scattering. We have also identified and characterized an intrinsically bent DNA region flanking the RNA polymerase I binding site of the ribosomal RNA gene in Physarum Polycephalum. Finally projects in progress are in the areas of studying the interatctions of histone H4 amino-terminus peptide 1-23 and acetylated 1-23 peptide with DNA using thermal denaturation; study of GGAAT repeats found in human centromeres using high resolution Nuclear magnetic Resonance and nuclease sentivity assay; and the role of histones and other sperm specific proteins with sperm chromatin.

1666 (DOE/ER/60700--5) **Advanced sequenching technology: Second year progress report.** Gesteland, R.F. Utah Univ.,

Salt Lake City, UT (United States). [1992]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-88ER60700. Order Number DE93001387. Source: OSTI; NTIS; GPO Dep.

This progress report briefly describes the laboratory's advances in chemiluminescent detectors for sequencing DNA, sequence reading algorithm, and for automation of sequencing.(DT)

1667 (EUR–12832) **Biotechnology an Overview of Applications and Impact on Environment.** Lecqq, A.F. Commission of the European Communities, Luxembourg (Luxembourg). 1990. 38p. Source: OSTI; NTIS (US Sales Only).

The state of art in the main areas of application of the biotechnologies i.e. pharmaceutical, chemical, agriculture and food industries as well as diagnosis, energy and environmental sectors is broadly reviewed. The present and possible future applications ongoing research and problems to be solved are considered. A greater importance is however given to the areas more closely related to the environment such as agriculture, energy production and pollution reduction. An overview of the possible risks and consequences to the environment and on man due to the use of these new technologies is also reported. Finally a suggestion for a possible contribution of the JRC in the field of biotechnology is proposed.

1668 (IS-T–1629) **Instrumental and theoretical development of capillary electrophoresis and its application to biological systems.** Lee, T.T. Ames Lab., IA (United States). 9 Sep 1992. 254p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-82. Order Number DE93001220. Source: OSTI; NTIS; GPO Dep.

Essential aspects of capillary electrophoresis (CE) are outlined. By integrating the electrophoretic current during electromigration, a migration index and an adjusted migration index are used to compare results obtained under changing conditions (constant and gradient fields, capillary lengths, inner diameters, ζ-potentials). Except for inner diameter cases, the indices are superior to all other indicators, and the qualitative precision of migration data is improved. Integration of the current during injection raises the quantitative precision of manual electrokinetic injection to the levels attained with hydrodynamic injection. A model based on field-amplified CE is proposed to describe the electrokinetic injection process involving samples with distinct conductivities and an equation is developed to allow normalization of peak areas at the 1–5 % level without the need for quantitative internal standardization. Experiments reveal that the model is valid when electromigration is the predominant mode of migration during injection. Design and performance of a rugged, compact, user-friendly and easily constructed laser-induced fluorescence (LIF) detector for CE are presented.

5504 Genetics

Refer also to citation(s) 318, 1665, 1666

1669 (DOE/BP/12885–1) **Genetic analysis of Oncorhynchus nerka: Annual progress report.** Brannon, E.L. (Idaho Univ., Moscow, ID (United States)); Setter, A.L.; Welsh, T.L.; Rocklage, S.J.; Thorgaard, G.H.; Cummings, S.A. Idaho Univ., Moscow, ID (United States). Jan 1992. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract BI79-90BP12885. Order Number DE92040084. Source: OSTI; NTIS; GPO Dep.

The 1990 project to develop DNA assessment techniques for the purpose of determining relationships among populations of Oncorhynchus nerka demonstrated differences that had potential for such application. The work was continued in 1991 with specific application of the techniques to develop DNA probes that could be used in separating populations of O. nerka associated with the lakes in the upper Salmon River, principally those in Redfish Lake. Research included sockeye-kokanee life history studies that might add supporting evidence for assessing the degree of difference or similarity among populations in the lake systems. This report summarizes the annual activities under the work plan.

1670 (DOE/ER/13967–T1) **[Genetics and biochemistry of surfactant synthesis in Rhodococcus sp. H13-A]: Final report.** North Carolina State Univ., Raleigh, NC (United States). Dept. of Microbiology. [1989]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-88ER13967. Order Number DE93000913. Source: OSTI; NTIS; GPO Dep.

The rationale for these studies resides is that biosurfactant synthesis occurs only when cells are grown with alkanes as sole source of carbon and energy. It is reasoned that biosurfactant synthesis is linked genetically to alkane oxidation and that the identification and characterization of the alk genes would provide information about the structural and regulator genes involved, in biosurfactant synthesis. Rhodococcus H13-A chromosomal DNA was isolated and digested with the restriction endonuclease Sau3A. The shuttle vector, pMVS301, was single site cleaved with Bgl II, phosphorylated, and the chromosomal DNA fragments agated into linearized pMVS301. The ligation mixture was used to transform competent E. coli HB101. The chromosomal DNA fragment has been cloned into pMVS301 which appears to contain genes encoding the initial oxidation of alkane. Electrophoration of Rhodococaus indicates transformation by this technique. Further studies are required to optimize conditions.

1671 (DOE/ER/60636–4) **Genes and gene expression: Localization, damage and control – A multi-level and interdisciplinary study: Progress report, February 1, 1992–January 31, 1993.** Ts'o, P.O.P. Johns Hopkins Univ., Baltimore, MD (United States). Aug 1992. 44p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-88ER60636. Order Number DE92041136. Source: OSTI; NTIS; GPO Dep.

This progress report describes gains made in three projects entitled (1) 3-Dimensional nuclear topography of genes and chromosomes in interphase nuclei, (2) Sequence specific identification and perturbation of the genomic DNA in living cells by nonionic oligonucleotide analogs (Matagen), and Resolution and isolation of specific DNA restriction fragments.(DT)

1672 (DOE/ER/61162–1) **International workshop on chromosome 3: Final report, April 15, 1991–April 14, 1992.** Gemmill, R.M. Eleanor Roosevelt Inst., Denver, CO (United States). Jul 1992. 54p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-91ER61162. (CONF-9104396–Absts.: 2. international workshop on Human Chromosome 3, Denver, CO (United States), 4-5 Apr 1991). Order Number DE93002732. Source: OSTI; NTIS; GPO Dep.

The Second Workshop on Human Chromosome 3 was held on April 4–5, 1991 at Denver, Colorado. There were 43 participants representing 8 nations. The workshop participants reviewed the current state of the chromosome 3 map, both physical and genetic, and prepared lists of markers and cell lines to be made commonly available. These markers and cell lines should be incorporated into the mapping efforts of diverse groups to permit the integration of data and development of consensus maps at future workshops. Region specific efforts were described for sections of the chromosome harboring genes thought to be involved in certain diseases including Von Hippel-Lindau disease, 3p- syndrome, lung cancer and renal cancer.

1673 (DOE/ER/61230–1) **[Development of a Human Genome Data Base]: Progress report.** Johns Hopkins Univ., Baltimore, MD (United States). [1992]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC02-91ER61230. Order Number DE92040626. Source: OSTI; NTIS; GPO Dep.

This report describes managerial aspects and briefly some technical accomplishments a Human Genome Database in Baltimore.

1674 (DOE/ER/61232–2) **[Multiplex mapping of human cDNAs]: Technical progress report.** Nierman, W.C. American Type Culture Collection, Rockville, MD (United States). [1992]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-91ER61232. Order Number DE93003066. Source: OSTI; NTIS; GPO Dep.

We have tested and implemented several protocols to increase productivity for mapping expressed sequence tags EST sequences to human chromosomes. These protocols include adopting PRIMER which permits utilization of batch files, as the standard software for PCR primer design; adding a human 21-only cell line to the NIGMS panel No. 1 to improve discrimination in discordancy

analyses involving chromosome 21, adding a monochromosomal hybrid panel to facilitate chromosome assignment of sequences that are amplified from more than 1 chromosome; combining the products of multiple PCR reactions for electrophoretic analysis (pseudoplexing); routinely multiplexing PCR reactions; and automating data entry and analysis as much as possible. We have applied these protocols to assign an overall total of 132 human brain CDNA sequences to individual human chromosomes. PCR primers were designed from ESTS and tested for specific amplification from human genomic DNA. DNA was then amplified using DNA from somatic cell hybrid mapping panels as templates. The amplification products were identified using an automated fluorescence detection system. Chromosomal assignments were made by discordancy analysis. The localized cDNAs include 2 for known human genes, 2 that map to 2 different human chromosomes, and 25 for cDNAs matching existing database records.

1675 (ORNL/RE–25-No.1) **Oak Ridge National Laboratory Review: Volume 25, No. 1, 1992.** Krause, C.; Pearce, J.; Zucker, A. (eds.). Oak Ridge National Lab., TN (United States). 1992. 92p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93000457. Source: OSTI; NTIS; GPO Dep.

This report presents brief descriptions of the following programs at Oak Ridge National Laboratory: The effects of pollution and climate change on forests; automation to improve the safety and efficiency of rearming battle tanks; new technologies for DNA sequencing; ORNL probes the human genome; ORNL as a supercomputer research center; paving the way to superconcrete made with polystyrene; a new look at supercritical water used in waste treatment; and small mammals as environmental monitors.

5505 Metabolism

Refer also to citation(s) 328

5506 Medicine

Refer also to citation(s) 306, 1418, 1728, 1729, 2051

1676 (BNL–47916) **Medical applications of synchrotron radiation at the National Synchrotron Light Source.** Thomlinson, W. Brookhaven National Lab., Upton, NY (United States). [1992]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-920821–1: 4. international conference on biophysics and synchrotron radiation, Tsukuba (Japan), 30 Aug - 5 sep 1992). Order Number DE93000374. Source: OSTI; NTIS; INIS; GPO Dep.

The overriding features of the synchrotron beams which make them applicable to medical research are their extremely high intensity and broadband energy spectrum. Several orders of magnitude separate the smooth, continuous spectrum of the synchrotron from the sharply peaked characteristic emission spectrum of a conventional source. Basically, the high intensity and tunability allow monochromatic beams to be generated at virtually any energy. The standard problem of beam hardening in both medical imaging and therapy is eliminated by the monochromatic beams since the energy spectrum does not change with passage through tissue. The tunable spectrum allows enhancement of images and therapeutic dose by selection of the most effective energy for a given procedure.

1677 (CONF-910529–, pp. 95-112) **Radiation absorbed dose and tumor response during therapy with iodine-131 conjugated 3F8 monoclonal antibody.** Cheung, N.K.V. (Memorial Sloan-Kettering Cancer Center, New York, NY (United States)); Pentlow, K.; Graham, M.C.; Yeh, S.J.; Finn, R.D.; Larson, S.M. American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., Atlanta, GA (United States). May 1992. DOE Contract FG02-86ER60407. From 5. international radiopharmaceutical dosimetry symposium; Oak Ridge, TN (United States); 7-10 May 1991. In *Fifth international radiopharmaceutical dosimetry symposium.* 625p. Order Number DE92013066. Source: OSTI; NTIS; INIS.

Optimal radioimmunotherapy (RIT) using murine antibody 3F8 against ganglioside G_{D2} in human neuroblastoma (NB) requires accurate measurement of radiation dose to tumor and normal organs. After intravenous (iv) injection of ^{131}-3F8 into nude mice xenografted with NB, serial planar gamma imaging and direct tumor size measurement provided tumor radioactivity uptake estimates (μCi/g) over time. Since the density of G_{D2} antigen in NB was high (5×10^6 molecules per cell), a large amount of antibody was needed to saturate all binding sites. A clear dose response was observed between 6.25 to 50 mCi/kg body wt of ^{131}I-3F8. The higher the administered activity, the more rapid and significant the shrinkage. The radiation absorbed dose for each individual tumor was calculated. Tumors that received > 4,200 rads were completely eradicated. The duration of tumor response was related to the radiation dose. The anti-tumor effect of 6-50 mCi/kg of iv ^{131}, I-3F8 was superior to single-fraction external beam radiation (250-1750 rads). The estimated tumor radiation dose was 150-200 rads/mCi/kg, while blood dose was 30-60 rads/mCi/kg. In patient studies, the calculated tumor radiation dose based on planar imaging, positron emission tomography(PET), as well as tissue biopsy was similar to the values estimated by animal experiments. The lack of organ toxicity (other than marrow and thyroid) was reproduced in clinical trials. The authors conclude that for 3F8 and NB, the athymic rodent xenograft model has provided a reasonable estimate of the radiation dose, in vivo tumor dose response, as well as the toxicity encountered during RIT.

1678 (DOE/ER/60434–7) **Boron in nuclear medicine: New synthetic approaches to PET and SPECT: Progress report, March 1, 1992–February 28, 1993.** Kabalka, G.W. Tennessee Univ., Knoxville, TN (United States). Dept. of Chemistry. Sep 1992. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-86ER60434. Order Number DE92040603. Source: OSTI; NTIS; INIS; GPO Dep.

This annual progress report describes new methods of incorporation of radioiodine into physiologically active compounds (amphetamines), and the use of organoboranes to labeled radiopharmaceuticals with Oxygen- 15, Nitrogen-13, carbon-11 and fluorine-18. Preclinical studies are also reported on evaluation of butyothiophenones as agents acting at dopaminergic or serotonic synapses.

1679 (DOE/ER/60561–7) **New techniques for positron emission tomography in the study of human neurological disorders: Progress report, 15 June 1992–31 October 1992.** Michigan Univ., Ann Arbor, MI (United States). [1992]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-87ER60561. Order Number DE93002098. Source: OSTI; NTIS; INIS; GPO Dep.

During the past six months, we have continued work on the fronts of kinetic modeling of radioligands for studying neurotransmitter/receptor systems, iterative reconstruction techniques, and methodology for PET cerebral blood flow activation studies. Initial human PET studies have been performed and analyzed with many different kinetic model formulations to determine the quantitative potential of the neuronwsmitter/receptor ligand, [^{11}C]N-methyl piperidyl benzilate (NMPB), a muscarinic cholinergic antagonist. In addition, initial human studies using [^{11}C]tetrabenazine (TBZ), a marker for monoantine nerve terminal density. Results of the NWB studies have indicated that this new agent yields better estimates of receptor density than previous muscarinic ligands developed at our facility, [^{11}C]-TRB and [^{11}C]scopolamine. TRB and scopolamine have previously been shown to be only partially successful ligands due to sub-optimal values of the individual rate constants, causing varying degrees of flow limitation. This is found to be much less of a problem for NMPB due to the 2.0–2.5 fold increase in ligand transport observed in the human studies (~60% first pass extraction). A 2-parameter 2-compartment simplification had previously been implemented for the benzodiazepine ligand, [C-11]FMZ, and a similar model appears to be suitable for TBZ based on the preliminary human data.

1680 (DOE/ER/61104–T1) **Institute of Medicine letter report: Committee to review the Idaho National Engineering Laboratory proposal to convert its Power Burst Facility for use**

in boron neutron capture therapy. National Academy of Sciences, Washington, DC (United States). 1990. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-91ER61104. Order Number DE92040996. Source: OSTI; NTIS; INIS; GPO Dep.

This report is the result of a request by the Secretary of Energy to the Institute of Medicine to convene an expert committee to evaluate the Idaho National Engineering Laboratory proposal to convert its Power Burst Facility (PBF) for use in research and development for Boron Neutron Capture Therapy (BNCT). The Committee was asked to conduct the evaluation within the context of the overall state of progress of BNCT as a potential therapeutic tool. The background for this request and review are provided first and they are followed by the Committee conclusions.

1681 (INIS-BR–2933, pp. 306) **Construction of a phantom for evaluating performance of NMR tomographs.** Muniz, B.A.T. (Sao Paulo Univ., Ribeirao Preto, SP (Brazil). Faculdade de Filosofia, Ciencias e Letras); Frare Junior, P.L.; Tannus, A.; Panepucci, H.C. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. PHANTOMS/nmr imaging; NUCLEAR MAGNETIC RESONANCE; PERFORMANCE; PHANTOMS; TOMOGRAPHY

1682 (INIS-BR–2939) **Proceedings of the 5. Latin American Congress of Ultrasound in Medicine and Biology; Seminar of the Inter American College of Radiology - Abstracts.** Colegio Brasileiro de Radiologia, Sao Paulo, SP (Brazil). 1991 232p. (In Portuguese). (CONF-9104394–: 5. Latin American Congress of Ultrasound in Medicine and Biology; Seminar of the Inter American College of Radiology, Sao Paulo (Brazil), 14-17 Apr 1991). Order Number DE93603710. Source: OSTI; NTIS (US Sales Only); INIS.

The works about general radiology, radiotherapy, obstetrics, gynecology, internal medicine and echo-ophthalmology are presented in these congresses. Imaging procedures, including computerized tomography, ultrasonography, scintiscanning, magnetic resonance and X radiation are also described. (C.G.C.).

1683 (INIS-BR–2939, pp. 54-55) **Contribution of the image methods in the study of Chagas disease.** Barros, N. de (Sao Paulo Univ., SP (Brazil). Faculdade de Medicina); Paladino, N.R.; Barbato, A.J.G.; Meneguetti, J.C.; Cerri, G.G.; Magalhaes, A.E.A. Colegio Brasileiro de Radiologia, Sao Paulo, SP (Brazil). 1991. 232p. (In Portuguese, English). (CONF-9104394–: 5. Latin American Congress of Ultrasound in Medicine and Biology; Seminar of the Inter American College of Radiology, Sao Paulo (Brazil), 14-17 Apr 1991). In *Proceedings of the 5. Latin American Congress of Ultrasound in Medicine and Biology; Seminar of the Inter American College of Radiology - Abstracts.* Order Number DE93603710. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. PARASITIC DISEASES/computerized tomography; PARASITIC DISEASES/diagnostic techniques; EPIDEMIOLOGY; NUCLEAR MEDICINE; TRYPANOSOMA; X RADIATION

1684 (INIS-BR–2939, pp. 56) **Hodgkin lymphoma attacking the chest: a case report.** Millbourn, M.W. (Escola Paulista de Medicina, Sao Paulo, SP (Brazil)); Gracino, A.; Yamashita, H. Colegio Brasileiro de Radiologia, Sao Paulo, SP (Brazil). 1991. 232p. (In Portuguese). (CONF-9104394–: 5. Latin American Congress of Ultrasound in Medicine and Biology; Seminar of the Inter American College of Radiology, Sao Paulo (Brazil), 14-17 Apr 1991). In *Proceedings of the 5. Latin American Congress of Ultrasound in Medicine and Biology; Seminar of the Inter American College of Radiology - Abstracts.* Order Number DE93603710. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. HODGKINS DISEASE/computerized tomography; BONE FRACTURES; CHEMOTHERAPY; CHEST; IMAGES; NECROSIS; X RADIATION

1685 (INIS-BR–2939, pp. 64) **Computerized tomography utilization in the diagnostic of chronicle mean otitis (OMC) and cholesteatomatous injuries in child: a case report.** Barba, M.F. (Sao Paulo Univ., SP (Brazil). Faculdade de Medicina); Vitule, L.F.; Scatigno Neto, A.; Rocha, M.S.; Cerri, G.G.; Magalhaes, A.A. Colegio Brasileiro de Radiologia, Sao Paulo, SP (Brazil). 1991. 232p. (In Portuguese). (CONF-9104394–: 5. Latin American Congress of Ultrasound in Medicine and Biology; Seminar of the Inter American College of Radiology, Sao Paulo (Brazil), 14-17 Apr 1991). In *Proceedings of the 5. Latin American Congress of Ultrasound in Medicine and Biology; Seminar of the Inter American College of Radiology - Abstracts.* Order Number DE93603710. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. AUDITORY ORGANS/computerized tomography; AUDITORY ORGANS/diagnosis; DIAGNOSIS; CHILDREN

1686 (INIS-BR–2939, pp. 79) **Desvitalization of renal tumors with ethilic alcohol: following with lipiodol tissular labelling.** Garces G, J.; Herrera, P.; Ormaza, F.; Calderon, J. Colegio Brasileiro de Radiologia, Sao Paulo, SP (Brazil). 1991. 232p. (In Spanish). (CONF-9104394–: 5. Latin American Congress of Ultrasound in Medicine and Biology; Seminar of the Inter American College of Radiology, Sao Paulo (Brazil), 14-17 Apr 1991). In *Proceedings of the 5. Latin American Congress of Ultrasound in Medicine and Biology; Seminar of the Inter American College of Radiology - Abstracts.* Order Number DE93603710. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. KIDNEYS/carcinomas; KIDNEYS/ethanol; KIDNEYS/lipiodol; BIOMEDICAL RADIOGRAPHY; COMPUTERIZED TOMOGRAPHY; KIDNEYS; CARCINOMAS; ETHANOL; LIPIODOL

1687 (INIS-BR–2939, pp. 94) **Common pitfalls in abdominal CT.** Wittenberg, J. Colegio Brasileiro de Radiologia, Sao Paulo, SP (Brazil). 1991. 232p. (CONF-9104394–: 5. Latin American Congress of Ultrasound in Medicine and Biology; Seminar of the Inter American College of Radiology, Sao Paulo (Brazil), 14-17 Apr 1991). In *Proceedings of the 5. Latin American Congress of Ultrasound in Medicine and Biology; Seminar of the Inter American College of Radiology - Abstracts.* Order Number DE93603710. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. ABDOMEN/computerized tomography; ABDOMEN/neoplasms; ABDOMEN; NEOPLASMS

1688 (INIS-BR–2939, pp. 92) **Computerized tomography and nuclear magnetic resonance in gastroenterology.** Elota, F.A. Colegio Brasileiro de Radiologia, Sao Paulo, SP (Brazil). 1991. 232p. (In Spanish). (CONF-9104394–: 5. Latin American Congress of Ultrasound in Medicine and Biology; Seminar of the Inter American College of Radiology, Sao Paulo (Brazil), 14-17 Apr 1991). In *Proceedings of the 5. Latin American Congress of Ultrasound in Medicine and Biology; Seminar of the Inter American College of Radiology - Abstracts.* Order Number DE93603710. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. GASTROINTESTINAL TRACT/computerized tomography; GASTROINTESTINAL TRACT/nuclear magnetic resonance; CHEMOTHERAPY; COMPARATIVE EVALUATIONS; DIAGNOSIS; IMAGES; NEOPLASMS

1689 (INIS-BR–2939, pp. 95) **Diagnostic and interventional CT of acute pancreatic inflammation.** Wittenberg, J. Colegio Brasileiro de Radiologia, Sao Paulo, SP (Brazil). 1991. 232p. (CONF-9104394–: 5. Latin American Congress of Ultrasound in Medicine and Biology; Seminar of the Inter American College of Radiology, Sao Paulo (Brazil), 14-17 Apr 1991). In *Proceedings of the 5. Latin American Congress of Ultrasound in Medicine and Biology; Seminar of the Inter American College of Radiology - Abstracts.* Order Number DE93603710. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. PANCREAS/computerized tomography; PANCREAS/diseases; DIAGNOSIS; IMAGES; PANCREAS; DISEASES

1690 (INIS-BR–2939, pp. 97-99) **CT of acute gastrointestinal disease.** Wittenberg, J. Colegio Brasileiro de Radiologia, Sao

Paulo, SP (Brazil). 1991. 232p. (CONF-9104394–: 5. Latin American Congress of Ultrasound in Medicine and Biology; Seminar of the Inter American College of Radiology, Sao Paulo (Brazil), 14-17 Apr 1991). In *Proceedings of the 5. Latin American Congress of Ultrasound in Medicine and Biology; Seminar of the Inter American College of Radiology - Abstracts.* Order Number DE93603710. Source: OSTI; NTIS (US Sales Only); INIS.

The application of computerized tomography in gastrointestinal tract diseases are presented, including advantages in surgical belly that are: anatomic clarity, wide survey and rapid performance. (C.G.C.).

1691 (INIS-BR–2939, pp. 29-30) **Intrahepatic stones: a case report.** Santos, A.M. dos (Pernambuco Univ., Recife, PE (Brazil). Hospital das Clinicas. Servico de Radiologia); Borba, P.Q. Colegio Brasileiro de Radiologia, Sao Paulo, SP (Brazil). 1991. 232p. (In Portuguese, English). (CONF-9104394–: 5. Latin American Congress of Ultrasound in Medicine and Biology; Seminar of the Inter American College of Radiology, Sao Paulo (Brazil), 14-17 Apr 1991). In *Proceedings of the 5. Latin American Congress of Ultrasound in Medicine and Biology; Seminar of the Inter American College of Radiology - Abstracts.* Order Number DE93603710. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. BILIARY TRACT/scintiscanning; LIVER/scintiscanning; SCINTISCANNING; IMAGES; LIVER; PATHOLOGY; TECHNETIUM 99 TARGET; ULTRASONIC WAVES; ULTRASONOGRAPHY

1692 (INIS-BR–2939, pp. 131) **Management of unknown primary tumors.** Jacobs, M.C.S. Colegio Brasileiro de Radiologia, Sao Paulo, SP (Brazil). 1991. 232p. (CONF-9104394–: 5. Latin American Congress of Ultrasound in Medicine and Biology; Seminar of the Inter American College of Radiology, Sao Paulo (Brazil), 14-17 Apr 1991). In *Proceedings of the 5. Latin American Congress of Ultrasound in Medicine and Biology; Seminar of the Inter American College of Radiology - Abstracts.* Order Number DE93603710. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. CHEST/computerized tomography; CHEST/metastases; CHEST/x radiation; CHEST; METASTASES; DIAGNOSIS

1693 (INIS-BR–2939, pp. 104-106) **Colon neoplasm.** Kimura F, K. Colegio Brasileiro de Radiologia, Sao Paulo, SP (Brazil). 1991. 232p. (In Spanish). (CONF-9104394–: 5. Latin American Congress of Ultrasound in Medicine and Biology; Seminar of the Inter American College of Radiology, Sao Paulo (Brazil), 14-17 Apr 1991). In *Proceedings of the 5. Latin American Congress of Ultrasound in Medicine and Biology; Seminar of the Inter American College of Radiology - Abstracts.* Order Number DE93603710. Source: OSTI; NTIS (US Sales Only); INIS.

The main aspects of colon neoplasms are described, including several factors that predispose the disease, the occurrence, the main biomedical radiography and the evaluation after the surgery. (C.G.C.).

1694 (INIS-BR–2939, pp. 111-113) **Abdominal abscess: diagnostic by image methods.** Kimura F, K. Colegio Brasileiro de Radiologia, Sao Paulo, SP (Brazil). 1991. 232p. (In Spanish). (CONF-9104394–: 5. Latin American Congress of Ultrasound in Medicine and Biology; Seminar of the Inter American College of Radiology, Sao Paulo (Brazil), 14-17 Apr 1991). In *Proceedings of the 5. Latin American Congress of Ultrasound in Medicine and Biology; Seminar of the Inter American College of Radiology - Abstracts.* Order Number DE93603710. Source: OSTI; NTIS (US Sales Only); INIS.

The main aspects of diagnostic methods for abdominal abscess are described, including some advantages and limitations of these methods. (C.G.C.).

1695 (INIS-BR–2939, pp. 114-115) **Lymphomas.** Kimura F, K. Colegio Brasileiro de Radiologia, Sao Paulo, SP (Brazil). 1991. 232p. (In Spanish). (CONF-9104394–: 5. Latin American Congress of Ultrasound in Medicine and Biology; Seminar of the Inter American College of Radiology, Sao Paulo (Brazil), 14-17 Apr 1991). In *Proceedings of the 5. Latin American Congress of Ultrasound in Medicine and Biology; Seminar of the Inter American College of Radiology - Abstracts.* Order Number DE93603710. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. LYMPHOMAS/diagnosis; LYMPHOMAS/evaluation; BIOMEDICAL RADIOGRAPHY; COMPUTERIZED TOMOGRAPHY; LYMPHOMAS; DIAGNOSIS; EVALUATION; MAGNETIC RESONANCE

1696 (INIS-BR–2939, pp. 116-117) **Computerized tomography in neoplasia of digestive tract.** Kimura F, K. Colegio Brasileiro de Radiologia, Sao Paulo, SP (Brazil). 1991. 232p. (In Spanish). (CONF-9104394–: 5. Latin American Congress of Ultrasound in Medicine and Biology; Seminar of the Inter American College of Radiology, Sao Paulo (Brazil), 14-17 Apr 1991). In *Proceedings of the 5. Latin American Congress of Ultrasound in Medicine and Biology; Seminar of the Inter American College of Radiology - Abstracts.* Order Number DE93603710. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. DIGESTIVE SYSTEM DISEASES/computerized tomography; COMPARATIVE EVALUATIONS; IMAGES; NEOPLASMS

1697 (INIS-BR–2939, pp. 118-119) **Liver: image methods.** Kimura F, K. Colegio Brasileiro de Radiologia, Sao Paulo, SP (Brazil). 1991. 232p. (In Spanish). (CONF-9104394–: 5. Latin American Congress of Ultrasound in Medicine and Biology; Seminar of the Inter American College of Radiology, Sao Paulo (Brazil), 14-17 Apr 1991). In *Proceedings of the 5. Latin American Congress of Ultrasound in Medicine and Biology; Seminar of the Inter American College of Radiology - Abstracts.* Order Number DE93603710. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. LIVER/biomedical radiography; LIVER/images; LIVER/pathology; COMPARATIVE EVALUATIONS; COMPUTERIZED TOMOGRAPHY; DIAGNOSIS; LIVER; IMAGES; PATHOLOGY; MAGNETIC RESONANCE; ULTRASONOGRAPHY

1698 (INIS-BR–2939, pp. 142) **Aneurysm of hepatic artery associated to dissected aneurysm of abdominal aorta.** Cesar, C.M.P. (Escola Paulista de Medicina, Sao Paulo, SP (Brazil)); Szejnfeld, J.; Gracino, A.; Pedrosa, M.L.; Ajzen, S.A. Colegio Brasileiro de Radiologia, Sao Paulo, SP (Brazil). 1991. 232p. (In Portuguese). (CONF-9104394–: 5. Latin American Congress of Ultrasound in Medicine and Biology; Seminar of the Inter American College of Radiology, Sao Paulo (Brazil), 14-17 Apr 1991). In *Proceedings of the 5. Latin American Congress of Ultrasound in Medicine and Biology; Seminar of the Inter American College of Radiology - Abstracts.* Order Number DE93603710. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. ABDOMEN/arteries; ABDOMEN/diseases; LIVER/arteries; LIVER/diseases; ABDOMEN; ARTERIES; DISEASES; BIOMEDICAL RADIOGRAPHY; COMPUTERIZED TOMOGRAPHY; LIVER; ULTRASONOGRAPHY

1699 (INIS-BR–2939, pp. 143) **Intracranial hemangiomas.** Granero, P.C. (Escola Paulista de Medicina, Sao Paulo, SP (Brazil)); Shiguihara, L.C.; Gianotti, I.A.; Stavale, J.A.; Seichas, M.T.; Lederman, H.M. Colegio Brasileiro de Radiologia, Sao Paulo, SP (Brazil). 1991. 232p. (In Portuguese). (CONF-9104394–: 5. Latin American Congress of Ultrasound in Medicine and Biology; Seminar of the Inter American College of Radiology, Sao Paulo (Brazil), 14-17 Apr 1991). In *Proceedings of the 5. Latin American Congress of Ultrasound in Medicine and Biology; Seminar of the Inter American College of Radiology - Abstracts.* Order Number DE93603710. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. SKULL/angiomas; SKULL/tomography; CHILDREN; IMAGES; MALFORMATIONS; SKULL; ANGIOMAS; TOMOGRAPHY

1700 (INIS-BR–2939, pp. 144) **Congenital epithelial splenial cyst in adult: ultrasonographic aspect.** Giggo, H.G. (Escola Paulista de Medicina, Sao Paulo, SP (Brazil)); Granero, P.C.; Castiglioni, M.L.V.; Kubota, E.S.; Ajzen, S.A.; Szenjfeld, J. Colegio Brasileiro de Radiologia, Sao Paulo, SP (Brazil). 1991. 232p. (In Portuguese). (CONF-9104394–: 5. Latin American Congress of Ultrasound in Medicine and Biology; Seminar of the Inter American College of Radiology, Sao Paulo (Brazil), 14-17 Apr 1991). In *Proceedings of the 5. Latin American Congress of Ultrasound in*

Medicine and Biology; Seminar of the Inter American College of Radiology - Abstracts. Order Number DE93603710. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. CYSTS/adults; CYSTS/comparative evaluations; CYSTS/ultrasonography; COMPUTERIZED TOMOGRAPHY; CONGENITAL DISEASES; CYSTS; ADULTS; ULTRASONOGRAPHY; EPITHELIUM; X RADIATION

1701 (INIS-BR–2939, pp. 130) **The significance of surgical staging in the management of carcinoma of the endometrium.** Jacobs, M.C.S. Colegio Brasileiro de Radiologia, Sao Paulo, SP (Brazil). 1991. 232p. (CONF-9104394–: 5. Latin American Congress of Ultrasound in Medicine and Biology; Seminar of the Inter American College of Radiology, Sao Paulo (Brazil), 14-17 Apr 1991). In *Proceedings of the 5. Latin American Congress of Ultrasound in Medicine and Biology; Seminar of the Inter American College of Radiology - Abstracts.* Order Number DE93603710. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. UTERUS/carcinomas; UTERUS/radiotherapy; SURGERY; UTERUS; CARCINOMAS; RADIOTHERAPY

1702 (INIS-BR–2939, pp. 132) **Intra-operative radiotherapy (IORT) in abdomino-pelvic malignancies.** Jacobs, M.C.E. Colegio Brasileiro de Radiologia, Sao Paulo, SP (Brazil). 1991. 232p. (CONF-9104394–: 5. Latin American Congress of Ultrasound in Medicine and Biology; Seminar of the Inter American College of Radiology, Sao Paulo (Brazil), 14-17 Apr 1991). In *Proceedings of the 5. Latin American Congress of Ultrasound in Medicine and Biology; Seminar of the Inter American College of Radiology - Abstracts.* Order Number DE93603710. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. ABDOMEN/neoplasms; ABDOMEN/pelvis; ABDOMEN/radiotherapy; PELVIS/abdomen; PELVIS/neoplasms; PELVIS/radiotherapy; ABDOMEN; NEOPLASMS; PELVIS; RADIOTHERAPY; SURGERY

1703 (INIS-BR–2939, pp. 133) **Glottic cancer and fraction size.** Jacobs, M.C.S. Colegio Brasileiro de Radiologia, Sao Paulo, SP (Brazil). 1991. 232p. (CONF-9104394–: 5. Latin American Congress of Ultrasound in Medicine and Biology; Seminar of the Inter American College of Radiology, Sao Paulo (Brazil), 14-17 Apr 1991). In *Proceedings of the 5. Latin American Congress of Ultrasound in Medicine and Biology; Seminar of the Inter American College of Radiology - Abstracts.* Order Number DE93603710. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. TONGUE/neoplasms; TONGUE/radiotherapy; TONGUE; NEOPLASMS; RADIOTHERAPY

1704 (INIS-BR–2939, pp. 134) **Combined chemotherapy and radiotherapy for advanced unresectable head and neck cancers.** Jacobs, M.C.S. Colegio Brasileiro de Radiologia, Sao Paulo, SP (Brazil). 1991. 232p. (CONF-9104394–: 5. Latin American Congress of Ultrasound in Medicine and Biology; Seminar of the Inter American College of Radiology, Sao Paulo (Brazil), 14-17 Apr 1991). In *Proceedings of the 5. Latin American Congress of Ultrasound in Medicine and Biology; Seminar of the Inter American College of Radiology - Abstracts.* Order Number DE93603710. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. HEAD/chemotherapy; HEAD/neoplasms; HEAD/radiotherapy; NECK/chemotherapy; NECK/neoplasms; NECK/radiotherapy; HEAD; CHEMOTHERAPY; NEOPLASMS; RADIOTHERAPY; NECK

1705 (INIS-BR–2939, pp. 205-213) **Ultrasound of the breast.** Fornage, B.D. (Texas Univ., Houston, TX (USA). Anderson Cancer Center). Colegio Brasileiro de Radiologia, Sao Paulo, SP (Brazil). 1991. 232p. (CONF-9104394–: 5. Latin American Congress of Ultrasound in Medicine and Biology; Seminar of the Inter American College of Radiology, Sao Paulo (Brazil), 14-17 Apr 1991). In *Proceedings of the 5. Latin American Congress of Ultrasound in Medicine and Biology; Seminar of the Inter American College of Radiology - Abstracts.* Order Number DE93603710. Source: OSTI; NTIS (US Sales Only); INIS.

The work presents the evaluation of breast diseases based on physical examination, mammography and the sonography. At present time sonography is the best adjunct to mammography. (C.G.C.).

1706 (IPNO-DRE–91-27) **Biomedical applications of radioactive nuclear beams.** Bimbot, R. Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire. 1991. 14p. (CONF-910815–: 2. international conference on radioactive nuclear beams, Louvain (Belgium), 19-21 Aug 1991). Order Number DE93720998. Source: OSTI; NTIS (US Sales Only); INIS.

Charged particles, such as protons and heavy ions, are increasingly used in cancer radiotherapy. With respect to the conventional treatment using photons or electrons, they offer the advantage of a better concentration of the dose deposition at a depth corresponding to the tumor location. Moreover, biological advantages of these highly ionizing particles have also been observed for the treatment of radioresistant tumors. Such treatments require high precision in the localization of the dose deposition which must coincide exactly with the tumor volume. The used of radioactive beams of β^+ emitters, at several hundreds of MeV/u, combined with positron emission tomography provide radiotherapeutists with a unique tool which may be used either for diagnostic purposes, prior to the actual treatment (performed with a stable beam of higher intensity), or for on line controlled treatment if the necessary intensities ($\simeq 10^8$ pps) become accessible in the future.

1707 (LIU-TEK-LIC–91-48) **Laser doppler perfusion imaging.** Waardell, K. Linkoeping Univ. (Sweden). Dept. of Biomedical Engineering. 1992. 107p. Order Number DE93603729. Source: OSTI; NTIS; INIS.

Recording of tissue perfusion is important in assessing the influence of peripheral vascular diseases on the microcirculation. This thesis reports on a laser doppler perfusion imager based on dynamic light scattering in tissue. When a low power He-Ne laser beam sequentally scans the tissue, moving blood cells generate doppler components in the back-scattered light. A fraction of this light is detected by a photodetector and converted into an electrical signal. In the processor, a signal proportional to the tissue perfusion at each measurement site is calculated and stored. When the scanning procedure is completed, a color-coded perfusion image is presented on a monitor. To convert important aspects of the perfusion image into more quantitative parameters, data analysis functions are implemented in the software. A theory describing the dependence of the distance between individual measurement points and detector on the system amplification factor is proposed and correction algorithms are presented. The performance of the laser doppler perfusion imager was evaluated using a flow simulator. A linear relationship between processor output signal and flow through the simulator was demonstrated for blood cell concentrations below 0.2%. The median sampling depth of the laser beam was simulated by a Monte Carlo technique and estimated to 235 μm. The perfusion imager has been used in the clinic to study perfusion changes in port wine stains treated with argon laser and to investigate the intensity and extension of the cutaneous axon reflex response after electrical nerve stimulation. The fact that perfusion can be visualized without touching the tissue implies elimination of sterilization problems, thus simplifying clinical investigations of perfusion in association with diagnosis and treatment of peripheral vascular diseases. 22 refs.

1708 (STUK-A–98) **Intercomparison of radiotherapy treatment planning systems using calculated and measured dose distributions for external photon and electron beams.** Kosunen, A.; Jaervinen, H.; Vatnitskij, S.; Ermakov, I.; Chervjakov, A.; Kulmala, J.; Pitkaenen, M.; Vaeyrynen, T.; Vaeaenaenen, A. Finnish Centre for Radiation and Nuclear Safety (STUK), Helsinki (Finland). Feb 1991. 48p. Order Number DE93603758. Source: OSTI; NTIS; INIS.

The requirement of 5 % overall accuracy for the target absorbed dose in radiotherapy implies that the accuracy of the relative dose calculation should be within only a few per cent. According to the recommendation by the International Commission on radiation units and measurements (ICRU), a computer-produced dose distribution can be considered to be accurate enough if it differs from the results of relative dose measurements by less than 2 %, or 2 mm in

the position of isodose curves involving very steep dose gradients. In this study five treatment planning systems, currently used by the hospitals in Finland or in the USSR, were intercompared with respect to the above requirement. Five typical cases of irradiation were selected: regular fields, oblique incidence, irregular field, wedge field and inhomogeneity in a water equivalent phantom. Complete dose distributions were used for the intercomparison, and the beam data for each TPS was that pertaining to the beam where the comparative relative measurements were performed. The results indicate that the dose distributions produced by different TPS:s can differ from each other as well as from the measured dose distributions up to a level which is not acceptable in terms of the above requirement. Greatest differences seem to be related to the omission or undue consideration of the scatter components of the beam. A suitable quality assurance program for the systematic testing of the performance of the treatment planning systems could be based on a selection of tests as used in this study.(orig.).

5507 Microbiology

Refer also to citation(s) 100, 327, 1555, 1562, 1664

5510 Physiological Systems

Refer also to citation(s) 1769

5530 Agriculture and Food Technology

Refer also to citation(s) 318, 321, 329, 1142

1709 (AECL–10343) **Dose rate effect in food irradiation: A review.** Singh, H. Atomic Energy of Canada Ltd., Pinawa, MB (Canada). Whiteshell Nuclear Research Establishment. Aug 1991. 76p. Order Number DE93603672. Source: OSTI; NTIS (US Sales Only); INIS.

It has been suggested that the minor losses of nutrients associated with radiation processing may be further reduced by irradiating foods at the high dose rates generally associated with electron beams from accelerators, rather than at the low dose rates typical of gamma irradiation (e.g. ^{60}Co). This review briefly examines available comparative data on gamma and electron irradiation of foods to evaluate these suggestions. (137 refs., 27 tabs., 11 figs.).

1710 (CRN-PN–91-13) **Ionization of bovine meat products. Microbiological, nutritional and organoleptic consequences.** Desmonts, M.H. Strasbourg-1 Univ., 67 (France); Strasbourg-1 Univ., 67 (France). Centre de Recherches Nucleaires. 28 Feb 1991. 227p. (In French). Order Number DE93720937. Source: OSTI; NTIS (US Sales Only); INIS.

In this thesis, the author analyses simultaneously the characteristics of sliced beef steaks, of minced beef steaks from industrial making and of beef and calf ionized liver rounds: microbiological quality, nutritional quality, and organoleptic quality. These analyses are systematically effected during 3 to 4 weeks on vacuum packaged products and stored at 3-4 deg C. The influence of ionization on microbiological, nutritional and organoleptic qualities is studied. These products are vacuum packaged in oxygen-porous films, ionized under accelerated electron with radiation doses from 1 to 5 kGy and stored at 3-4 deg C during 3-4 weeks. Then, other parameters are studied : fats rate of minced steaks (5 and 10%), packing quality (oxygen-tight packing and oxygen-porous film) and finally, the radiation dose rate (X or gamma-radiation and accelerated electrons). In conclusion, the ionization allows to improve the preservation time of vacuum packaged beef and calf liver rounds. Meat can be preserved during 10-14 days after having received a radiation dose of 3-4 kGy, without nutritional quality alteration.

1711 (DOE/AL/24327–T1, pp. 5-15) **Introduction to an irradiation project.** Vail, P.V.; Baritelle, J.L.; Rhodes, A.A. Agricultural Research Service, Washington, DC (United States); Economic Research Service, Washington, DC (United States). 1 Jun 1986. In *Irradiation disinfestation of dried fruits and nuts. Final report.* 263p. Order Number DE92018561. Source: OSTI; NTIS.

This paper describes the completion of a cooperative research project for the use of irradiation as a disinfestation procedure for dried fruits and nuts. The insects investigated were the codling moth (Cydia pomonella), navel orangeworm (Ameylois transitella), Indianmeal moth (Plodia interpunctella), and one species of driedfruit beetle (Carpophilus hemipterus). Radiation doses of 0, 150, 300, 600, and 900 Gy and other doses, as required, were to be tested. Taste panel data were collected in order to evaluate the effect of radiation on the products tests. Quality was examined immediately after irradiation and again after accelerated conditions equivalent to one year's storage. The specific areas of research and responsibilities for the US DOE, USDA, CH2M HILL, the dried fruit and nut industry groups, Oregon State University, and the University of California, Riverside, are described.

1712 (DOE/AL/24327–T1, pp. 17-44) **Overview of food irradiation technology.** Sloan, D. (CH2M Hill, Albuquerque, NM (United States)). Agricultural Research Service, Washington, DC (United States); Economic Research Service, Washington, DC (United States). 1 Jun 1986. In *Irradiation disinfestation of dried fruits and nuts. Final report.* 263p. Order Number DE92018561. Source: OSTI; NTIS.

Food irradiation is an emerging technology that utilizes ionizing radiation to help reduce food losses after harvest. The author reviews the process and discusses issues of commercialization, safety, and product response. The advantages and disadvantages which must be weighed in choosing a radiation source for a given application are then explored. Sources include cobalt 60, cesium 137, electron beams, and X-rays.

1713 (DOE/AL/24327–T1, pp. 45-67) **Irradiator design and selection.** Sloan, D. (CH2M Hill, Albuquerque, NM (United States)). Agricultural Research Service, Washington, DC (United States); Economic Research Service, Washington, DC (United States). 1 Jun 1986. In *Irradiation disinfestation of dried fruits and nuts. Final report.* 263p. Order Number DE92018561. Source: OSTI; NTIS.

Although detailed design can be somewhat complicated, a food irradiation system is very simple in concept. The principal components for an isotopic irradiators or a facility with a machine-generated radiation source include: (1) the radiation source; (2) a conveyor system to bring the product into the ionizing radiation chamber and back out again; (3) radiation shielding; (4) system controls to operate and manage a safe process. The radiation sources have already been briefly discussed in a previous section. The other irradiator components are addressed in this paper.

1714 (DOE/AL/24327–T1, pp. 69-111) **Efficacy of gamma radiation treatments for insect disinfestation of selected dried fruits and nuts.** Johnson, J.A. (Dept. of Agriculture, Fresno, CA (United States)); Vail, P.V. Agricultural Research Service, Washington, DC (United States); Economic Research Service, Washington, DC (United States). 1 Jun 1986. In *Irradiation disinfestation of dried fruits and nuts. Final report.* 263p. Order Number DE92018561. Source: OSTI; NTIS.

The primary research objective was to develop efficacy data on radiation treatments against Indianmeal moth, Plodia interpunctella (Huebner), navel orangeworm, Amyelois transitella (Walker) and driedfruit beetle, Carpophilus hemipterus (L.). Earlier work done on these and other species indicated that control could be obtained by treatment at doses not exceeding the FDA limit of 1 kGy (100 krad). while considerable information exists on the radiation doses required to prevent reproduction in numerous insect species, data on larval mortality and feeding behavior after irradiation are limited. In particular, the effectiveness of radiation in reducing commodity damage from feeding larvae is poorly understood. The authors research was therefore directed at determining the dose required to prevent reproduction and minimize feeding damage. As was expected, all stages of the DFB proved to be relatively radiosensitive, with 300 Gy preventing reproduction of pupae and adults and development of larvae. Complete mortality of irradiated adults and pupae occurred within one week after treatment. While exact measurements of larval longevity after treatment were not made, visual examination of treated raisins yielded no noticeable living larvae by two weeks after irradiation, with the youngest larvae dying even sooner. Thus, for the DFB, radiation as a control method does not have the same disadvantages found with lepdopterous larvae. The study indicates that gamma radiation treatments off 300 Gy would

provide control comparable to that obtained with methyl bromide treatments.

1715 (DOE/AL/24327–T1, pp. 113-134) **Efficacy of gamma radiation treatments for disinfestation of walnuts infested by codling moth larvae.** Burditt, A.K. Jr. (Dept. of Agriculture, Yakima, WA (United States)). Agricultural Research Service, Washington, DC (United States); Economic Research Service, Washington, DC (United States). 1 Jun 1986. In *Irradiation disinfestation of dried fruits and nuts. Final report.* 263p. Order Number DE92018561. Source: OSTI; NTIS.

The effect of gamma radiation for the disinfestation of walnuts infested by codling moth (Cydia pomonella) larvae was determined by treatment of nuts containing mature, cocooned larvae. In order to estimate the dosage required to prevent emergence of adults from mature larvae, a total of 26 trays, each containing about 380 infested apples, were held under conditions for production of larvae. Mature larvae left the apples and entered the nuts in search of a suitable site in which to spin their cocoons. Infested nuts were exposed to 42.3 or 84.6 Gy gamma radiation supplied by an AECL gammabeam-650 irradiator. Results show that irradiation significantly reduced emergence of normal adults. The dose required for quarantine security (99.9968% mortality) was 188 Gy based on emergence of any adults from treated larvae.

1716 (DOE/AL/24327–T1, pp. 135-167) **Quality evaluation of irradiated dried fruits and tree nuts.** Fuller, G. (Dept. of Agriculture, Albany, CA (United States)). Agricultural Research Service, Washington, DC (United States); Economic Research Service, Washington, DC (United States). 1 Jun 1986. In *Irradiation disinfestation of dried fruits and nuts. Final report.* 263p. Order Number DE92018561. Source: OSTI; NTIS.

Irradiation of agricultural commodities offers an alternative to fumigation as a means of insect disinfestation. The attractiveness of irradiation depends on a number of factors: economics, availability of chemical fumigants, and whether or not consumers accept the irradiated product. Samples of dried fruits and nuts were given doses of 150, 300, 600, and 900 Gy using cesium-137 as the source of gamma radiation. Results show that irradiation up to 900 Gy did not cause immediate deterioration in organoleptic quality of any of the commodities tested. With storage time, differences were more frequent or more noticeable at the higher irradiation levels. It was recommended that irradiation of the commodities, especially walnuts, be done at less than 600 Gy, preferably at 300-450 Gy. Multiple doses appear to be acceptable as long as the total dose does not exceed the limit. However, current regulations allow only a single irradiation. Since the study used accelerated storage, it was suggested that storage tests at ambient temperature should be evaluated. These could include additional factors such as possible protection by use of antioxidants.

1717 (DOE/AL/24327–T1, pp. 169-229) **Economic engineering feasibility of irradiation as a postharvest disinfestation treatment for California dried fruits and nuts.** Rhodes, A.A. (Univ. of California, Riverside (United States)); Baritelle, J.L. Agricultural Research Service, Washington, DC (United States); Economic Research Service, Washington, DC (United States). 1 Jun 1986. In *Irradiation disinfestation of dried fruits and nuts. Final report.* 263p. Order Number DE92018561. Source: OSTI; NTIS.

The purpose of this study is to evaluate the economic engineering feasibility of irradiation as a disinfestation treatment for California dried fruits and nuts. The study focuses on the four largest dried fruit and nut crops: almonds, walnuts, raisins and prunes, for which irradiation is most likely to be economical. The study compares irradiation with current practice, i.e. fumigation and other chemical controls, as well as with other alternatives to current practice: modified atmospheres and refrigeration. Possible insect control programs to replace all chemical treatments using either modified atmospheres and refrigeration alone, or some combination of modified atmospheres, refrigeration and irradiation are described, and the costs of these insect control programs are estimated. In the event that replacements for chemical controls must be found, new insect control concepts may be developed which may be superior to all those considered here. Nevertheless, the results of this study identify which, if any, dried fruit and nut disinfestation needs might possibly best be served by irradiation, at least in the event that chemical controls are not available. At the same time, estimated costs of alternative insect control programs are provided, which place an upper bound on the cost of replacing some of all chemical controls by alternative treatments.

1718 (IC–92/170) **Spontaneous regulating mechanisms that may have led to the origin of life.** Chela Flores, J. International Centre for Theoretical Physics, Trieste (Italy). Jul 1992. 13p. Order Number DE93603677. Source: OSTI; NTIS (US Sales Only); INIS.

According to Salam condensation may be relevant in biochemistry, as a factor contributing to the homochirality of amino acids. We attempt to show that DNA packaging may be modelled, by interpreting chromatin as a form of soft matter, in which a phase transition has induced chromatin into a condensed mode. In the context of the origin of life we show the relevance of simultaneous discussion of DNA packaging, transcription, and DNA replication. Beyond a certain critical length of the protogenome (RNA), physical properties of inert condensed matter may have given rise to a spontaneous regulating mechanism of certain significance for the evolution of life on Earth. (author). 31 refs, 1 tab.

1719 (INIS-mf–13349, pp. 36-37) **Identification of irradiation of some foodstuffs using thermoluminesence procedure.** Sharifzadeh, M. (Atomic Energy Organization of Iran (Iran, Islamic Republic of) Gamma Irradiation Center); Sohrabpour, M. Iranian Physics Society, Teheran (Iran, Islamic Republic of). 1991. 53p. (In Persian). (CONF-9109417–: Iran's physics conference, Isfahan (Iran, Islamic Republic of), 10 Sep 1991). In *Abstract of articles from Iran's physics conference.* Order Number DE93000811. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. DATES/irradiation; DATES/thermoluminescent dosimetry; FOOD PROCESSING/irradiation; PEPPERS/irradiation; PEPPERS/thermoluminescent dosimetry; SPICES/irradiation; SPICES/thermoluminescent dosimetry; DATES; IRRADIATION; PEPPERS; PHOTON EMISSION; SPICES; THERMOLUMINESCENCE

1720 (KAERI/RR–1018/90) **Studies on safety and efficiency of gamma-irradiated ginseng: Development of irradiation techniques for quality improvement of ginseng products.** Kwon, Joong Ho (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Cho, Han Ok; Byun, Myung Wo; Kim, Suc Won; Yang, Jae Seong; Yoo, Young Soo; Jin, Joon Ha; Park, Soon Chul. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Sep 1991. 88p. (In Korean). Order Number DE93605571. Source: OSTI; NTIS (US Sales Only); INIS.

Gamma irradiation was applied to the biological quality improvement and preservation of white ginseng which has problems in a hygienic quality and storage stability. The current phosphine treatment showed no influence on microorganisms contaminated even though it was very useful for disinfestation of the sample, while 5 kGy irradiation effectively controlled the biological quality of the stored sample, with minimal effects on the quality parameters of white ginseng. Thus, it is concluded that gamma irradiation at a range of 5 kGy can be an alternative method of chemical fumigants provided air-tight packaging excluding recontamination is used for the stored product. (Author).

1721 (KAERI/RR–1065/91) **Statistical study on cancer patients of cancer research hospital.** Shim, Yoon Sang (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Choi, Soo Yong; Won, Hyuk; Kim, Kee Hwa. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Jan 1991. 47p. (In Korean). Order Number DE93605569. Source: OSTI; NTIS (US Sales Only); INIS.

The total number of malignant neoplasms included on this study 7,787 cases(10.4%) among 74,928 cases for 2 years. On sex, females with 57.6% were much more than males with 42.4%. The highest proportion of cancer 50-59 age group. The most frequent primary site among males was found to be stomach with 36.2%, followed by liver(12.3%), lung(12.2%), esophagus(15.5%) and larynx(4.9%). In females, the first order was uterine cervix with 47.3%, followed most common type of morphology of malignant neoplasms was adenocarcinoma(39.0%) in males an squamous cell carcinoma(56.2%) in females. Among the cancer patients initially

diagnosed in this hospital, the proportion of malignant neoplasms by the extent of disease was 4.6% for patient with carcinoma-in-situ, 76.3% for patients with localized involvement, 11.6% for patients with regional involvement and 7.5% for patients with distant involvement. Among,the cancer patients initially treatment in this hospital, the proportion of malignant neoplasms by the method of treatment was 19.0% for surgery, 27.7 for radiotherapy and 24.2% for chemotherapy. Among the cancer patients confirmed by medical records, 11.2% was traced more than 5 years. (Author).

1722 (KAERI/RR–1097/91) **The application of irradiation techniques to food and foodstuffs.** Kwon, Joong Ho (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Cho, Han Ok; Byun, Myung Woo; Kim, Suc Won; Yang, Jae Seong. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Feb 1992. 162p. (In Korean). Order Number DE93605572. Source: OSTI; NTIS (US Sales Only); INIS.

To establish concrete infrastructure required for food irradiation commercialization, the project was designed to investigate the efficiency of irradiation techniques, such as preserving boiled-dried anchovy and improving its safety, improving the physical quality of soybeans and microbial-immobilization with radiation-induced polymer. Dried anchovies could be kept in a sanitary quality for over one year at cooling conditions (<10 deg C) instead of freezing by using 5 KGy-irradiation and airtight packaging(NY/PE). Gamma irradiation below 10 KGy was significantly effective for improving the hydration and cooking properties of soybeans. Immobilized microorganisms showed an increased-catalytic activity, producing lactic acid 15 times higher than that of free culture. (Author).

1723 (KAERI/RR–1099/91) **Studies on the application of radiation for genetic transformation in higher plants.** Lee, Young Il (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Song, Hi Sup; Kim, Jae Sung; Shin, In Chul; Lee, Sang Jae; Lee, Ki Woon; Lim, Yong Taek. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Feb 1992. 99p. (In Korean). Order Number DE93605567. Source: OSTI; NTIS (US Sales Only); INIS.

Present research carried out to develop the radiation application on the mutation research of genetic engineering. Some variants selected in M1 generation derived from the plantlet by the nodal stem culture of three potato cultivars irradiated with gamma rays, and the optimum dosage for mutation induction was revealed the range of 30 - 50 Gy of gamma ray. In the rice anther culture of the plant irradiated with gamma rays at different developmental stage of microspore, the haploidy callus formation rates were much higher in gamma ray irradiated anthers than those of non-irradiated, and the occurrence of a typical pollen was significantly increased up to 47% in the anthers irradiated with 30 Gy of gamma ray compared with 11% of non-irradiated anthers at the stage of pollen mother cell. A lot of variants were selected in rice, soybean, perilla and red pepper irradiated with gamma rays for breeding of earliness, short culm, high yielding and disease resistant mutant. (Author).

1724 (PCCF-T–92-01) **Study of chemistry transformations of in vivo implanted coral by nuclear analysis methods.** Sauvage, T. Clermont-Ferrand-2 Univ., 63 - Aubiere (France). Lab. de Physique Corpusculaire. Jan 1992. 141p. (In French). Order Number DE93721006. Source: OSTI; NTIS (US Sales Only); INIS.

Neutron activation analysis and use of radioactive tracers, completed by X-rays diffraction, allowed us to quantitatively study the transformations in a biomaterial (coral) implanted 'in vivo'. Before its implantation, the biomaterial is sterilized. Sterilization by thermal effect or irradiation does not induce any macroscopic modification of the crystal structure: the biomaterial preserves its biocompatible properties. Coral was implanted in ovine and procine thighbones. Biopsies were extracted after different implantation times (1 to 24 weeks). The analyzed samples for each biopsy are the intermediate part (initially the coral) and the cortical next to the implant. We have measured the concentrations of Ca, P, Sr and Mg by neutron activation, as a function of the time of implantation. The results show that the mineral composition of the intermediate part is greatly modified. The concentrations of Ca, P, Sr and Mg become comparable to those of a mature about 3 to 5 months after implantation, depending upon the experimentation. The X-rays diffraction analysis of the implant reveals a gradual substitution of the coral aragonite crystal structure by an apatitic structure. The radioactive marking of Ca and Sr, initially constituting coral, allowed to measure the transfers of elements in organism and to specify the mechanisms of its transformations. This study exhibits a Ca and Sr contribution from organism for the bone neoformation. After five months, the calcium of the implant is no longer the one from the biomaterial. These results, obtained by sensitive and selective nuclear methods, suggest a biomaterial resorption followed by a formation of apatite. 68 figs., 57 tabs.

1725 (VTT-TIED–1027) **Identification of irradiated spices with aid of scintillation counter.** Uusheimo, K. (Technical Research Centre of Finland, Espoo (Finland). Reactor Lab.). Technical Research Centre of Finland, Espoo (Finland). Aug 1989. 36p. (In Finnish). Order Number DE93605573. Source: OSTI; NTIS; INIS.

The aim off the work was to determine how one can identify gamma-irradiated spices with aid of a scintillation counter (LKB/Wallac 1219 RackBeta Spectral) by chemiluminescence measurements. Even though scintillation counters are more sensitive than real luminometers they have not been capable in identifying the irradiated spices after contact with photosensitizer like luminol, isoluminol and lucigenin presumably because the actual chemiluminescence reaction took place before the sample vial reached the measuring range. Whereas it was noticed that the identification of pure, dry allspice, black pepper, white peppar and cardemom was possible without any solutions when there were also present similar unirradiated spices. The identification was possible even after 23 weeks duration depending on the dose of the irradiation (10 kGy or 50 kGy) and the weight of the samples (1 g or 9 g). The duration of the investigation was 23 weeks.

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5601 Radiation Effects

Refer also to citation(s) 295, 297, 614, 1677, 1711, 1712, 1714, 1715, 1717, 1765

1726 (AECL–8407) **Potential health hazard of nuclear fuel waste and uranium ore.** Mehta, K.; Sherman, G.R.; King, S.G. Atomic Energy of Canada Ltd., Pinawa, MB (Canada). Whiteshell Nuclear Research Establishment. Jun 1991. 47p. Order Number DE93603662. Source: OSTI; NTIS (US Sales Only); INIS.

The variation of the radioactivity of nuclear fuel waste (used fuel and fuel reprocessing waste) with time, and the potential health hazard (or inherent radiotoxicity) resulting from its ingestion are estimated for CANDU (Canada Deuterium Uranium) natural-uranium reactors. Four groups of radionuclides in the nuclear fuel waste are considered: actinides, fission products, activation products of zircaloy, and activation products of fuel impurities. Contributions from each of these groups to the radioactivity and to the potential health hazard are compared and discussed. The potential health hazard resulting from used fuel is then compared with that of uranium ore, mine tailings and refined uranium (fresh fuel) on the basis of equivalent amounts of uranium. The computer code HAZARD, specifically developed for these computations, is described.

1727 (AECL–10563) **Review of ICRP Publication 60.** Heinmiller, B.E. Atomic Energy of Canada Ltd., Chalk River, ON (Canada). Chalk River Nuclear Labs. Jan 1992. 27p. Order Number DE93603685. Source: OSTI; NTIS (US Sales Only); INIS.

The recommendations of the ICRP were last formulated in 1977. The ICRP has periodically reviewed the recommendations and issued supplementary reports on specific topics. Over the last several years, enough new information accumulated on health effects from exposure to ionizing radiation to change appreciably the assumed risk estimates from such exposure, and to prompt the ICRP to reassess its recommendations for radiological protection. The resulting recommendations were approved by the ICRP in 1990 November. This report examines the recommendations from three perspectives. The first section of the report presents background information on the development of the recommendations and the risk

estimates on which they are based. The main reasons for the increase in current risk estimates from previous estimates are given. The second section of the report outlines the basic ICRP recommendations that are relevant to occupational and public radiological protection, and offers interpretation where needed. The third section of the report examines implications of the recommendations for dosimetry. the ICRP is currently working on improvements to some metabolic and dosimetric models. Because it is difficult, in some instances, to decouple the implications of this modelling work and the implications of the new recommendations, both are examined in this third section. This report documents why radiological protection standards have changed recently, what the current standards are, and how they might affect radiation dosimetry. (4 tabs., 15 refs.).

1728 (BNWL-CC–250) **Use of total beta counts to estimate GI tract dose rates.** Hall, R.B. Pacific Northwest Lab., Richland, WA (United States). 25 Oct 1965. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93001317. Source: OSTI; NTIS; GPO Dep.

It was the practice for several years to estimate the potential dose rate to the gastrointestinal from sanitary water sources by evaluating the results of radiochemical analysis of individual nuclides. The proposed method estimates the GI tract dose from Pasco and Richland domestic water from measurements of the total beta activity, and permits more frequent and more economical evaluation of a variable source of radiation exposure. Beginning with 1964 data, the GI tract dose rate for Richland and Pasco sanitary water has been obtained by multiplying the total beta count by a conversion factor derived from the historical relationship between the radiochemical analyses and the total beta counts. Either the accumulation of more data or changes in the relative abundance of the more significant nuclides in the water may result in changes in this factor.

1729 (CONF-910529–, pp. 151) **Radium-223: An alpha emitter for radioimmunotherapy.** Fisher, D.R. (Pacific Northwest Lab., Richland, WA (United States)); Hui, T.E.; Wester, D.W.; Wai, C.M. American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., Atlanta, GA (United States). May 1992. DOE Contract AC06-76RL01830 ;AM06-70RL02225. From 5. international radiopharmaceutical dosimetry symposium; Oak Ridge, TN (United States); 7-10 May 1991. In *Fifth international radiopharmaceutical dosimetry symposium.* 625p. Order Number DE92013066. Source: OSTI; NTIS; INIS.

Two concerns have previously been cited for discounting the radionuclide ^{223}Ra (physical half-life = 11.4 d) as a suitable alpha-emitter for radioimmunotherapy: the lack of any ligand for binding radium to its delivery protein, and a suggested dosimetric disadvantage due to the 36-min. half-life of its unbound, third decay product, ^{211}Pb. However, ^{223}Ra can indeed be tightly bound to a suitable ligand without dissolution of free Ra^{++} in body fluids. Moreover, the radiation dosimetry of a ^{223} Ra-labeled monoclonal antibody should be highly favorable for radioimmunotherapy, even with redistribution of ^{211}Pb. In addition, the 11.4-d half-life allows for immunoconjugate preparation, administration, and tumor localization by carrier antibodies before significant radiological decay takes place. The short-lived decay products of ^{223} Ra, contribute to the estimated tumor/normal tissue dose ratio, and together with ^{223} Ra, provide a cascade of 3-4 alpha particles per Ra atom that should be highly effective in tumor cell-killing while sparing normal tissues. Photons from 223 Ra (in the ^{99m}Tc energy window) provide a means for tumor imaging and dosimetry. Radium-223 may be produced economically and in sufficient amount for wide-scale application. A generator system for on-site elution of carrier-free ^{223} Ra has also been proposed.

1730 (CONF-910529–, pp. 544-556) **Localized beta dosimetry of ^{131}I in human thyroid.** Hui, T.E. (Pacific Northwest Lab., Richland, WA (United States)); Fisher, D.R.; Johnson, J.R. American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., Atlanta, GA (United States). May 1992. DOE Contract AC06-76RL01830 ;AM06-70RL02225. From 5. international radiopharmaceutical dosimetry symposium; Oak Ridge, TN (United States); 7-10 May 1991. In *Fifth international radiopharmaceutical dosimetry symposium.* 625p. Order Number DE92013066. Source: OSTI; NTIS; INIS.

Localized beta dose distribution in human thyroid from ^{131}I was simulated using a geometrical thyroid model. The model consisted of a hexagonal-close-packed lattice of spherical follicles having a mean follicular diameter of about 200 μm. The wall of each thyroid follicle consists of a single layer of cuboidal follicular cells having an approximate thickness of 15 μm. The localized dose was calculated using the Berger point kernel formula for absorbed dose distributions of beta particles in water. Four factors affecting the localized beta dose distribution were considered: (1) the activity level of ^{131}I within the colloid of follicles, compared to that in follicular cells and the interfollicular space; (2) the diameter of follicles; (3) the fraction of follicles that actively concentrates iodide during the time of exposure; and (4) the fraction of lobules of follicles that are active during the time of exposure. The spatial distribution of dose at the multicellular level was calculated for a thyroid having an average absorbed dose of 1 Gy. No significant difference was found in the localized dose when the ^{131}I activity level within follicles varied from 25 to 75 times the activity level within follicular cells and interfollicular spaces, or when the average follicular diameter varied from 170 to 230 μm. In these situations, the localized dose was found to range from 0.8 to 1.2 Gy, varying by only 20% of the mean. However, if only 20% of follicles were active at any time during the exposure, the localized dose was found to be highly non-uniform, ranging from 0.4 to 3.0 Cy, and varying by a factor of 2.5 to 3 from the average thyroid dose. Finally, if only 20% of lobules of follicles were active at any time during the exposure, the localized dose was found to be highly non-uniform.

1731 (CRN-PN–91-24) **Applied dosimetry to ionization techniques by electron beams.** Kuntz, F. Strasbourg-1 Univ., 67 (France). Centre de Recherches Nucleaires. Dec 1991. 131p. (In French). Order Number DE93721008. Source: OSTI; NTIS (US Sales Only); INIS.

After a general introduction about electron beam dosimetry, the second part is about the determination of treatment parameter for an electron ionization: are treated the problems of electron path determination, treatment depth of a product and finally, the radiation dose heterogeneities in all the volume of a treated product. The third part describes a process that greatly reduces radiation dose heterogeneity and then industrial interest is analyzed. The fourth part describes 2 applications of diffusion screen utilization. 66 figs.

1732 (DOE/EH/89150–1) **Committee on Radiation Epidemiological Research Programs: Progress report, April 1, 1991–March 31, 1992.** Mahlum, D.D. National Research Council, Washington, DC (United States). Board on Radiation Effects Research. Jun 1992. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-91EH89150. Order Number DE92040516. Source: OSTI; NTIS; GPO Dep.

The Committee on DoE Radiation Epidemiological Research Programs was originally established in response to the needs of the Office of Health and Envirorunental Research, Office of Energy Research in the Department of Energy (DoE). Following a reorganization of DoE health related programs in 1990, the committee now advises the Office of Epidemiology and Health Surveillance which is under the Assistant Secretary for Environment, Safety and Health. These administrative changes have not altered the committee concerns but have served to focus the committee's attention on helping DoE plan for an effective system of worker health surveillance as well as an epidemiologic research program.

1733 (DOE/ER/60742–5) **An immunochemical approach to the study of DNA damage and repair: Technical progress report, May 1, 1989–April 30, 1992.** Wallace, S.S. (Vermont Univ., Burlington, VT (United States). Dept. of Microbiology and Molecular Genetics); Erlanger, B.F. Vermont Univ., Burlington, VT (United States). Dept. of Microbiology and Molecular Genetics. May 1992. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-88ER60742. Order Number DE93003122. Source: OSTI; NTIS; INIS; GPO Dep.

The overall objective of this project has been to develop immunochemical methods to quantitate unique DNA base damages in order to facilitate studies on radiation-induced damage production and repair. Specifically, we have been using antibodies raised to damaged bases to quantitate unique lesions in model systems in order to evaluate their potential biological consequences. Our

approach has been to synthesize modified nucleotides or nucleosides, conjugate them to protein carriers, and use the conjugates as immunogens in rabbits or to prepare monoclonal antibodies. We have been studying damages that are stable radiolysis products found in X-irradiated DNA and thus of potential biological consequence. Our aim is to build an in vitro and in vivo data base on the interactions between model DNA lesions and such cellular enzymes as DNA polymerases and repair endonucleases. Initial studies have focused on pyrimidine ring saturation products (thymine glycol.and dihydrothymine), products resulting from ring fragmentation or base loss (urea, B-ureidoisobutyric acid, abasic sites), 7-hydro-8-oxopurines, and more recently, cytosine radiolysis products. These modified bases serve as useful models for examining the potential lethal and/or mutagenic (carcinogenic) effects of the products of DNA radiolysis.

1734 (DOE/ER/60912–T1) **Radiation-induced microncephaly in guinea pigs.** Wagner, L.K.; Johnston, D.A.; Felleman, D.J. Texas Univ., Houston, TX (United States). [1992]. 29p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-89ER60912. Order Number DE93002866. Source: OSTI; NTIS; GPO Dep.

The effect of x rays on brain weight of guinea pig pups at birth was studied for 21-day old embroys exposed in utero to doses of 75 and 100 mGy. When compared to controls and when corrected for body weight, gestation time, litter size, sex, and examiner differences the brains of irradiated pups weighed approximately 46 mg less than those of controls ($p<0.001$) for the 75-mGy group and about 55 mg less for the 100-mGy group. Brains of females weighed 51 mg less than those of males of the same body weight. Dam weight and caging conditions had no observed effect on brain weight.

1735 (DOE/ER/61136–2) **An improved method for producing radiation hybrids applied to human chromosome 19: Technical progress report.** Jackson, C.L.; Mark, H.F.L. Rhode Island Hospital, Providence, RI (United States). [1992]. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-91ER61136. Order Number DE93003156. Source: OSTI; NTIS; GPO Dep.

Using radiation hybrids from a monochromosomal microcell hybrid containing human chromosome 19 as its only human component (PK87-19), we have initiated analysis of a panel of hybrids for markers in known locations on human chromosome 19. Also begun was a fluorescent in situ hybridization analysis of the hybrid cell lines using biotinylated total human DNA as a hybridization probe to metaphase chromosomes prepared from the hybrids cell lines. We are analyzing our panel of 94 hybrids for additional markers obtained from the literature, or the genome data base as well as to complete the analysis of any hybrids not yet scored for the markers iii the table. The hybrid panel has been tested for apolipoprotein C_2 for the radiation hybrids for D19SI77 (mfd 120), D19SI78 (mfd 139) and for HRC (histidine rich calcium binding protein). In addition we have also analyzed for the presence of slow troponin 1 (TNNT1) and GPI (glucose phosphate isomerase).

1736 (DOE/OR/00033–T486) **Effects of α-particle radiation on rat tracheal epithelial cells.** Ford, J.R. Jr. Oak Ridge Associated Universities, Inc., TN. (United States). Aug 1992. 173p. Sponsored by USDOE, Washington, DC (United States); Department of Health and Human Services, Washington, DC (United States). DOE Contract AC05-76OR00033 ;AC05-84OR21400. Grant 2R01 CA34695. Order Number DE92041036. Source: OSTI; NTIS; INIS; GPO Dep.

Thesis submitted to the Univ. of Tennessee, Knoxville.

By a combination of methods, which included flow cytometry and magnetic cell sorting, we have demonstrated that the cells of the rat tracheal epithelium which have the greatest proliferative capacity in culture and in vivo are the basal cells. Because of these findings it seems reasonable to suppose that the basal cells are the most likely target for the action of α-particle radiation in pseudostratified respiratory epithelium. This hypothesis is further supported by the finding that the basal cells are the cells which appear to respond to the tumor promoter 12-O-tetradecanoylphorbol-13-acetate. The effects of ^{210}Po α-particles on the survival and oncogenic transformation of rat tracheal epithelial cells in suspension were investigated. Since these effects were assayed in culture, the results pertain to the reaction of only the basal cells to irradiation. The results indicate that α-particles are extremely cytotoxic in that a track segment of 4 μm, on average, is sufficient to cause the reproductive death of basal cells. This finding is supported by similar results obtained with two cell lines, Mv1Lu and CHO-K1 BH_4. Production of proliferating epithelial foci by α-particles was not distinguishable from control and sham treatments. These results are in direct conflict with many of the results that have been obtained with C3H 1OT1/2 cells in similar transformation assays. Some possible reasons for these disparities are discussed and supporting evidence is provided.

1737 (DOE/RW–0362-SR) **Science, society, and America's nuclear waste: Unit 2, Ionizing radiation.** USDOE Office of Civilian Radioactive Waste Management, Washington, DC (United States). [1992]. 41p. Sponsored by USDOE, Washington, DC (United States). Source: OSTI (Free of Charge); INIS.

High-energy, ionizing radiation is called ionizing because it can knock electrons out of atoms and molecules, creating electrically charged particles called ions. Material that ionizing radiation passes through absorbs energy from the radiation mainly through this process of ionization. Ionizing radiation can be used for many beneficial purposes, but it also can cause serious, negative health effects. That is why it is one of the most thoroughly studied subjects in modern science. Most of our attention in this publication is focused on ionizing radiation – what it is, where it comes from, and some of its properties.

1738 (EHD-TR–152) **Environmental radioactivity in Canada 1988: Radiological monitoring annual report.** Department of National Health and Welfare, Ottawa, ON (Canada). Health Protection Branch. 1991. 46p. Order Number DE93603693. Source: OSTI; NTIS (US Sales Only); INIS.

The radiological surveillance program of the Department of National Health and Welfare is conducted for the purpose of determining levels of environmental radioactivity in Canada and assessing the resulting population exposures. Following major changes to the CAMECO Port Hope operations to reduce uranium emissions, a study was initiated to measure uranium levels in air in the community. Studies continued on lung cancer and domestic exposure to radon, and current levels of cesium-137 in caribou, a major source of food in northern communities. The movement of tritium on the Ottawa and St. Lawrence rivers was studied following an accidental release into the Ottawa River. Monitoring continued of fallout contamination from Chernobyl in imported foods. All measurements recorded during 1988 were below the limits recommended by the International Commission on Radiological Protection. (14 refs., 14 figs., 15 tabs.).

1739 (IGC–123) **Review of literature on bioassay methods for estimating radionuclides in urine.** Prasad, M.V.R.; Surya Narayana, D.S.; Jeevanram, R.K.; Sundarajan, A.R. Indira Gandhi Centre for Atomic Research, Kalpakkam (India). 1991. 55p. Order Number DE93605558. Source: OSTI; NTIS (US Sales Only); INIS.

Bioassay methods of certain important radionuclides encountered in the nuclear fuel cycle operations, viz., thorium, uranium, sup(239)Pu, sup(241)Am, sup(90)Sr, sup(99)Tc, sup(106)Ru, sup(137)Cs are reviewed, with special emphasis on urinalysis. Since the preconcentration is an important prerequisite for bioassay, various preconcentration methods are also discussed. Brief account of various instruments both nuclear and analytical used in the bioassay programme is included. The sensitivities of the methods cited in the literature vis-a-vis the derived recording levels indicated in ICRP recommendations are compared. Literature surveyed up to 1990 is tabulated. (author). 96 refs., 1 fig ., 3 tabs.

1740 (INFO–0300-2) **Childhood leukaemia around Canadian nuclear facilities. Phase 2: Final report.** Clarke, E.A. (Ontario Cancer Treatment and Research Foundation, Ottawa, ON (Canada)); McLaughlin, J.; Anderson, T.W. Atomic Energy Control Board, Ottawa, ON (Canada). Jun 1991. 94p. Order Number DE93603650. Source: OSTI; NTIS (US Sales Only); INIS.

Prompted by findings of increased occurrence of childhood leukaemia in the vicinity of some nuclear facilities in the United

Kingdom, this study aimed to investigate whether the frequency of leukaemia among children born to mothers living near nuclear facilities in Ontario differed from the provincial average. The Ontario Cancer Registry was used to identify 1894 children aged 0 to 14 years who died from leukaemia between 1950 and 1987, and 1814 children who were diagnosed with leukaemia between 1964 and 1986. Residence at birth and death was obtained from birth and death certificates. Analyses were performed separately for nuclear research and development facilities; uranium mining, milling and refining facilities; and, nuclear generating stations; and for areas within the same county as the facility and 'nearby' - within a 25-km radius of the facility. Risk estimates were calculated as the ratio of the observed (O) number of events over the expected (E) number. In the vicinity of nuclear research and development facilities the rate of leukaemia was less than expected and within the bound of chance variation. In the areas around the uranium mining, milling and refining facilities and nuclear power plants leukaemia occurred slightly more frequently than expected, but due to small frequencies these differences may have arisen due to chance. Large differences between observed and expected rates were not detected around any of the Ontario facilities. This study was large enough to detect excess risks of the magnitude reported in the United Kingdom, but it was not large enough to discriminate between the observed relative risks and a chance finding. Levels of leukaemia detected near nuclear generating stations indicate the need for further investigation. (20 tabs., 15 figs., 32 refs.).

1741 (INFO–0363) **Physical characteristics and solubility of long-lived airborne particulates in uranium producing and manufacturing facilities: A report upon completion of Phase I of the study.** Robertson, R. (Becquerel Laboratories Inc. (Canada)); Jones, S. Atomic Energy Control Board, Ottawa, ON (Canada). Oct 1988. 27p. Project 4.103.2. Order Number DE93603663. Source: OSTI; NTIS (US Sales Only); INIS.

The rates of dissolution in simulated lung fluid of uranium-238, thorium-230, radium-226, and lead-210 from a uranium ore matrix and of uranium-238 only from a uranium dioxide matrix have been studied. Changes in solubility rates accompanying changes in lung fluid pH and flow rate were examined. The effect of neutron irradiation of the solid matrices upon solubility was investigated. Using the carrier-free tracer isotopes, thorium-234, radium-224, and lead-203, the hold-back effects of coprecipitation and adsorption upon available surfaces within the dissolution cells were explored. It was found that a shift from pH 7 to 8 in the lung fluid phase reduces uranium-238 solubility by about 10%, thorium-230 by about 90%, and radium-226 by approximately 40%. There is no discernible effect upon lead-210. Within the range of the flow rates studied, it has been found that the solubility rates of all the elements of interest do not change significantly in moving from an approximately constant lung fluid flow rate to a flow rate decreasing with time. Results indicate that fast neutron irradiation of a uranium ore matrix reduces the solubility rate of uranium-238 by about 50%, of thorium-230 by 20-30% and of radium-226 by 20-30%. There was no discernible effect on lead-210. Similar irradiation of a uranium dioxide matrix appeared to have no effect on uranium-238 solubility. The integrated fast neutron flux was approximately 5×10^{14} neutrons per centimetre squared in both cases. The irradiation was by reactor neutrons under cadmium and represents the irradiation conditions typically used for the determination of uranium and thorium on aerosol filters by neutron activation analysis. Tracer studies showed that coprecipitation and adsorption effects play a prominent role in determining the rates of extraction of thorium and lead from the extraction cells used in this work. The effect for radium is small. (2 refs., 16 tabs., fig.).

1742 (INFO–0363-1) **Physical characteristics and solubility of long-lived airborne particulates in uranium producing and manufacturing facilities: A report upon completion of the extension to Phase I of the study.** Robertson, R. (Becquerel Laboratories Inc. (Canada)); Jones, S. Atomic Energy Control Board, Ottawa, ON (Canada). Aug 1989. 22p. Project 4.103.2. Order Number DE93603664. Source: OSTI; NTIS (US Sales Only); INIS.

The rate of dissolution in simulated lung fluid of uranium from three different ore matrices and from refined uranium dioxide has been studied in an essentially all teflon extraction apparatus. The rate of dissolution of thorium from a nickel metal/2% thoria mixture has been similarly studied. The effect of neutron irradiation of the studied materials upon the above dissolution rates has been investigated. The adsorption of the radioisotope tracers barium 133 (substitute for radium), lead 203 and thorium 234 upon the extraction system components has been examined. It has been found that the thoria component of the nickel/thoria material is essentially totally insoluble. No thorium was detected in any of the six lung fluid fractions collected and the total thorium removed from 50 mg samples under the experimental conditions was < 0.5% of the thorium present in the starting material. Neutron irradiation of the uranium ores and of uranium dioxide for two minutes under cadmium using an epicadmium neutron flux of about 5×10^{11} n cm^{-2} s^{-1} increases uranium solubility by 5% to 35% depending on the sample material. There was no observable effect on the nickel/thoria material. (3 refs., 7 tabs., fig.).

1743 (INFO–0377) **Toxicity and dosimetry of tritium: A review.** Myers, D.K.; Johnson, J.R. Atomic Energy Control Board, Ottawa, ON (Canada). Advisory Committee on Radiological Protection. Jan 1991. 112p. (In English, French). (ACRP–10;CCRP–10.). Order Number DE93605552. Source: OSTI; NTIS (US Sales Only); INIS.

Tritium doses to the general public are very low (currently about 0.2 μSv per year). Radiation doses from tritium to members of the public living in the vicinity of a CANDU power station are higher but rarely exceed 20 μSv per year or 1% of normal exposures to radiation from all natural sources, but doses to some radiation workers can approach ten mSv per year. The relative biological effectiveness (RBE) of tritium beta rays varies appreciably depending upon the biological endpoint. Observed RBE values at low doses and low dose-rates are usually about 2 to 3 when tritium beta rays are compared to ^{60}Co gamma rays but are closer to 1 than to 2 when compared to 200 kVp X-rays. This conclusion is supported by microdosimetric considerations of the quality of tritium beta rays, ^{60}Co gamma rays and X-rays. Since X-rays have traditionally been accepted as reference radiation by the International Commission on Radiological Protection, it seems reasonable that the quality factor (Q) assigned to tritium beta rays should be close to one. Recommended procedures in Canada for estimation of effective dose equivalents from exposures to HTO and HT assume that Q = 1 and that body water represents 67% of the mass of soft tissue; they take into account conversions of HTO to appear to be reasonable for radiation protection purposes when the source of exposure is HTO or HT, but will not be adequate for exposures to other tritiated compounds. (modified author abstract) (137 refs., 11 figs., 12 tabs.).

1744 (INFO–0389) **A review of radiation risk estimates.** Atomic Energy Control Board, Ottawa, ON (Canada). Advisory Committee on Radiological Protection. Jun 1991. 120p. (ACRP–13.). Order Number DE93603651. Source: OSTI; NTIS (US Sales Only); INIS.

Three authoritative reports (UNSCEAR-1988, BEIR-V-1990, and ICRP-1990 Recommendations) on risk estimates have been reviewed and compared to previous risk estimates published by the same organizations. The ICRP now uses the term 'probability' in place of the term 'risk'. For fatal cancers, the new ICRP probability estimates are 5.0×10^{-2} Sv^{-1} for a population of all ages and 4.0×10^{-2} Sv^{-1} for a population of working age. For serious hereditary effects summarized over all generations, the ICRP probability coefficients are 1.0×10^{-2} Sv^{-1} for a population of all ages and 0.6×10^{-2} Sv^{-1} for a population of working age. For prenatal irradiation, at 8 - 15 weeks after conception, there may be a decrease of 30 I.Q. points per Sv and a risk of cancer which may lie in the range of 2 to 10×10^{-2} Sv^{-1}. Based mainly on the new probability estimates the ICRP recommends a limit on effective dose of 20 mSv per year, averaged over 5 years (100 mSv in 5 years) with the further provision that the effective dose should not exceed 50 mSv in any single year. For public exposure the ICRP recommends an annual limit on effective dose of 1 mSv. However, in special circumstances, a higher value of effective dose could be allowed in a single year provided that the average over 5 five years does not exceed 1 mSv per year. Once pregnancy has been declared, the

conceptus should be protected by applying a supplementary equivalent dose limit to the surface of the woman's abdomen of 2 mSv for the remainder of the pregnancy and by limiting intakes of radionuclides to about 1/20 of the annual limit on intake. A brief survey of epidemiological studies of workers and the risks from radon and thoron progeny is also included. (110 refs, 29 tabs., 10 figs.).

1745 (INFO–0401) **Tritium releases from the Pickering Nuclear Generating Station and birth defects and infant mortality in nearby communities 1971-1988.** Johnson, K.C. (Department of National Health and Welfare, Ottawa, ON (Canada). Lab. Centre for Disease Control); Rouleau, J. Atomic Energy Control Board, Ottawa, ON (Canada). Oct 1991. 105p. Project 7.156.1. Order Number DE93603652. Source: OSTI; NTIS (US Sales Only); INIS.

This study was commissioned to examine whether there were elevated rates of stillbirth, birth defects, or death in the first year of life between 1971 and 1988 among offspring of residents of communities within a 25-kilometre radius of the Pickering Nuclear Generating Station. The study was also to investigate whether there were any statistical associations between the monthly airborne or waterborne tritium emissions from the Pickering Nuclear Generating Station and the rates of these reproductive outcomes. Overall analysis did not support a hypothesis of increased rates of stillbirths, neonatal mortality or infant mortality near the Pickering Nuclear Generating Station, or a hypothesis of increased birth prevalence of birth defects for 21 of 22 diagnostic categories. The prevalence of Down Syndrome was elevated in both Pickering and Ajax; however, there was no consistent pattern between tritium release levels and Down Syndrome prevalence, chance could not be ruled out for the associations between Down Syndrome and tritium releases or ground-monitored concentrations, the association was detected in an analysis where multiple testing was done which may turn up significant associations by change, and maternal residence at birth and early in pregnancy needs to be verified. The association between Down Syndrome and low-level radiation remains indeterminate when existing evidence from epidemiological studies is summed. The estimated radiation exposure from the nuclear plant for residents of Pickering and Ajax is lower by a factor of 100 than the normal natural background radiation. Further study is recommended. (21 tabs., 29 figs., 5 maps, 37 refs.).

1746 (INFO–0402) **Guidelines for the medical surveillance of atomic radiation workers.** Atomic Energy Control Board, Ottawa, ON (Canada). Group of Medical Advisers. Nov 1991. 20p. (In English, French). (GMA–1.). Order Number DE93605610. Source: OSTI; NTIS (US Sales Only); INIS.

These guidelines are provided for the use and guidance of occupational physicians concerned with the medical surveillance of atomic radiation workers (ARWs). Persons employed in industries where there is exposure to ionizing radiation should be screened medically for fitness for certain jobs before starting such work and at appropriate intervals while employed. This includes workers at uranium mines, mills and refineries, nuclear fuel fabrication plants, nuclear power plants and research facilities, and facilities using radionuclides in an industrial setting. An important purpose of medical surveillance is to ensure that workers are fit both physically and psychologically to undertake the tasks they may be called upon to perform.

1747 (INFO–0405) **Estimation of lung tissue doses following exposure to low-LET radiation in the Canadian study of cancer following multiple fluoroscopies.** Howe, G.R.; Yaffe, M. Atomic Energy Control Board, Ottawa, ON (Canada). Feb 1992. 55p. Project 6.114.1 and 6.114.2. Order Number DE93603653. Source: OSTI; NTIS (US Sales Only); INIS.

Lung tissue doses from exposure to external low-LET radiation have been estimated for each year between 1930 and 1960 for 92,707 tuberculosis patients first treated in Canadian institutions between 1930 and 1952. Many of these patients received multiple chest fluoroscopies together with treatment by artificial pneumothorax, and thus accumulated doses up to 15.7 grays. The estimated doses have been used in a statistical analysis of lung cancer mortality between 1950 and 1987 occurring among 64,698 patients known to be alive at the start of 1950, and followed by linkage to the Canadian national mortality data base. There were substantial variations in the total cumulative lung tissue dose received by the cohort, with 2,490 individuals having doses in excess of 1.7 grays. A total of 1,156 lung cancer deaths was observed in the cohort, and these have been used to estimate relative risks. The most appropriate risk model appears to be a simple linear relative risk function, with an excess relative risk coefficient of 0.089 for an absorbed dose of 1 gray. This contrasts with estimates of relative risk based on the atomic bomb survivors study, for which the excess relative risk coefficient for males 20 years after the first exposure is estimated to be 0.64. The difference is statistically significant. It is postulated that fractionation and dose rate effectiveness factors may account for some of the discrepancy. (Modified author abstract) (14 refs., 20 tabs.).

1748 (INFO–0416) **Childhood leukemia around five nuclear facilities in Canada.** Elaguppillai, V. Atomic Energy Control Board, Ottawa, ON (Canada). May 1992. 5p. (CONF-9205118–: 2. international conference on effects of low-dose ionizing radiation, Bournemouth (United Kingdom), 18-20 May 1992). Order Number DE93603654. Source: OSTI; NTIS (US Sales Only); INIS.

As a result of public concern over the incidence of leukemia around the Sellafield nuclear fuel reprocessing plant, the Canadian Atomic Energy Control Board commissioned a study to test for similar clustering around licensed nuclear facilities in Ontario. In this study the incidence and mortality of leukemia among children up to the age of 14 years born within a radius of about 25 km from five different types of facilities were compared to the provincial average. The facilities considered were the Pickering Nuclear Generating Station, the Bruce Nuclear Power Development, the uranium conversion facility at Port Hope, the uranium mine and mill facilities in Elliot Lake, and the Chalk River Laboratories. The ratio of observed to expected childhood leukemias was around unity at the 95 percent confidence level, indicating that the occurrence of the disease is not significantly different from the provincial average. The sample size is not large enough to distinguish between a change occurrence and a true excess or deficit. (table).

1749 (INFO–0420) **Effects of microdistribution of tritium on dose calculations.** Prestwich, W.V.; Kwok, C.S.; Nunes, J. Atomic Energy Control Board, Ottawa, ON (Canada). Jun 1992. 63p. Order Number DE93603665. Source: OSTI; NTIS (US Sales Only); INIS.

Literature and data pertaining to the microdosimetry, relative biological effectiveness, subcellular distribution, organ uptake and retention for organically-bound tritium are reviewed. The quality factor for the electron degradation spectrum associated with the radiation field of tritium β-rays in water was calculated. The value was found to be $1.9 \pm .2$. A related experimental measure of quality with value $1.6 \pm .2$ and an estimate of 1.3 based on simulation studies are cited. The average value for relative biological effectiveness for a data base of 55 values was found to be $1.8 \pm .1$. The influence of reference radiation, in vivo versus in vitro methodologies, and the use of tritiated thymidine or tritiated water are discussed. A methodology designed to estimate the effects of subcellular distribution is described and a suitable parameter, the localization factor defined. Estimates of this factor are made for both nuclear-bound and organically-bound tritium. Values of 4 and 1.5 respectively are suggested. Organ uptake studies in rodents following long-term feeding of organically-bound tritium are compared. The tritium is found to be unequally distributed among the tissues studied. The highest specific activity occurs in liver, with the lowest in femur. The specific activity of tritium in tissue-free water slightly exceeds that of organically-bound tritium in liver. Retention studies reveal a three-component exponential decrease of organically-bound tritium. No discernible trends of the periods of the three components with specific organs could be established. Average values of the periods are $1.2 \pm .2$, 10 ± 2, and 65 ± 8 days. It is concluded that specific enhancement of radiobiological effectiveness due to incorporation of tritium in DNA does probably not occur. The radiotoxicological impact of organically-bound tritium could warrant the use of a radiation weighing factor between 2 and 3.

1750 (INFO–0421) **Comments on ICRP-60 rationale for dose limits for the pregnant worker.** Myers, D.K. Atomic Energy Control Board, Ottawa, ON (Canada). Jun 1992. 62p. Order Number DE93603686. Source: OSTI; NTIS (US Sales Only); INIS.

ICRP Publication 60 has recently recommended new dose limits for the radiation exposure of pregnant workers. These new dose limits for pregnant workers are more restrictive than the current limits in force in Canada. Recent presentations by Dr. R.H. Mole have faulted the arguments provided by ICRP as justification for reducing the previously recommended limits for pregnant radiation workers. The present paper provides a brief review of the development of the human conceptus, of the biological effects of low doses of radiation on the foetus, and discusses R.H. Mole's comments on ICRP-60. On the critical issues concerning the presence or absence of threshold doses for induction of specific biological endpoints, Dr. Mole and ICRP-60 appear to be in agreement. The basic disagreement between Dr. Mole and ICRP-60 seems to revolve around the philosophical question of whether dose limits should be based on quantitative risks to the foetus or whether dose limits to the pregnant worker should provide a standard of protection to the foetus which is broadly comparable with that provided for members of the general public. Further research is recommended on one of the topics raised by Dr. Mole, namely, foetal doses from radionuclides inhaled or ingested by the mother.

1751 (INIS-BR–2939, pp. 127-128) **Radioprotection in radiodiagnosis in Brazil.** Araujo, A.M.C. de (Instituto de Radioprotecao e Dosimetria (IRD), Rio de Janeiro, RJ (Brazil)). Colegio Brasileiro de Radiologia, Sao Paulo, SP (Brazil). 1991. 232p. (In Portuguese). (CONF-9104394–: 5. Latin American Congress of Ultrasound in Medicine and Biology; Seminar of the Inter American College of Radiology, Sao Paulo (Brazil), 14-17 Apr 1991). In *Proceedings of the 5. Latin American Congress of Ultrasound in Medicine and Biology; Seminar of the Inter American College of Radiology - Abstracts.* Order Number DE93603710. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. RADIATION PROTECTION/diagnosis; RADIATION PROTECTION/nuclear medicine; RADIATION PROTECTION/research programs; BRAZIL; DIAGNOSIS

1752 (INIS-BR–2939, pp. 123) **The control of ionizing radiation use in Sao Paulo State.** Furnari, L. (Secretaria de Estado da Saude, Sao Paulo, SP (Brazil)); Craveiro, P.M.; Aldred, M.A.; Fujisawa, S.; Costa, P.R. Colegio Brasileiro de Radiologia, Sao Paulo, SP (Brazil). 1991. 232p. (In Portuguese). (CONF-9104394–: 5. Latin American Congress of Ultrasound in Medicine and Biology; Seminar of the Inter American College of Radiology, Sao Paulo (Brazil), 14-17 Apr 1991). In *Proceedings of the 5. Latin American Congress of Ultrasound in Medicine and Biology; Seminar of the Inter American College of Radiology - Abstracts.* Order Number DE93603710. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. IONIZING RADIATIONS/radiation monitoring; IONIZING RADIATIONS/safety standards

1753 (INIS-mf–13349, pp. 38-39) **Thermal neutron flux and gamma dose distribution in the phantom of head in boron neutron therapy.** Marashi, M.Kh. (Atomic Energy Organization of Iran, Teheran (Iran, Islamic Republic of). Nuclear Research Centre). Iranian Physics Society, Teheran (Iran, Islamic Republic of). 1991. 53p. (In Persian). (CONF-9109417–: Iran's physics conference, Isfahan (Iran, Islamic Republic of), 10 Sep 1991). In *Abstract of articles from Iran's physics conference.* Order Number DE93000811. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. PHANTOMS/gamma radiation; PHANTOMS/neutron flux; BORON 10; DEPTH DOSE DISTRIBUTIONS; HEAD; NEUTRON THERAPY; NEUTRON TRANSPORT; PHANTOMS; RADIATION DOSES; THERMAL NEUTRONS

1754 (KAERI/RR–998/90) **A development of computer code for evaluating internal radiation dose through ingestion and inhalation pathways.** Lee, Jeong Ho (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Lee, Chang Woo; Choi, Yong Ho; Chun, Ki Jung; Kim, Kook Chan; Kim, Sang Bok; Kim, Jin Kyu. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Jul 1991. 460p. (In Korean). Order Number DE93605612. Source: OSTI; NTIS (US Sales Only); INIS.

The computer codes were developed to evaluate internal radiation dose when radioactive isotopes released from nuclear facilities are taken through ingestion and inhalation pathways. Food chain models and relevant data base representing the agricultural and social environment of Korea are set up. An equilibrium model-KFOOD, which can deal with routine releases from a nuclear facility and a dynamic model-ECOREA, which is suitable for the description of acute radioactivity release following nuclear accident. (Author).

1755 (KAERI/RR–1045/91) **The probabilistic risk assessment due to indoor exposure to ^{222}Rn daughters in Korea.** Chang, S. Y. (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Ha, C. W.; Yoon, C. C.; Seo, K. W.; Kim, B. H.; Chung, D. Y.; Kim, R. I.; Kim, J. S. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Jan 1992. 115p. (In Korean). Order Number DE93605553. Source: OSTI; NTIS (US Sales Only); INIS.

A small radon chamber system was designed to experimentally analyze the behavior of radon daughters which are currently believed to be a dominant source of human exposure to natural radiation, to calibrate various radon detectors and to participate in the intercomparison of radon measurement, IAEA coordinated research program on 'Radon in the Humen Environment' in which KAERI participates. A computer program RADEQ(Radon Daughter Equilibrium) was developed to analyze the behaviours of radon daughters. Lung cancer rates in Korean males and females were derived from the 1989 Korean life table and annual statistics on death data. From these, the lifetime baseline risk of lung cancer mortality among Koreans was mathematically estimated, and the excess lung cancer risk, attributable to indoor exposure to the radon daughters was estimated for the first time in Korea from the excess risk coefficient per radon daughters exposure(WLM) by using a modified relative risk projection model for stochastic effect of ionizing radiation. (Author).

1756 (KAERI/RR–1070/91) **The development of dose evaluation program for personnel radiation dosimetry.** Yoon, Suk Chul (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Ha, Chung Woo; Lee, Tae Young; Kim, Jang Lyul; Kim, Bong Hwan; Jeong, Deok Yeon; Lee, Ki Chang; Kim, Chang Kyung. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Jan 1991. 114p. (In Korean). Order Number DE93605611. Source: OSTI; NTIS (US Sales Only); INIS.

The final goal of this three-year project is to develop a standard dose evaluation program of personnel dosimetry and to take part in the NVLAP of the NIST in the U.S.A. This will provide KAERI with the transfer of acquired high technology to Korea nuclear industry. The main purpose of the study in the first year was to develop the related S/W techniques and comply with the ANSI N13.11 test categories(I,II,III,and IV). We analysed the characters of ANSI N13.11 and made the counter-measure for this. Half Value Layer and Spectroscopy Technique were used for the measurements of effective X-ray energies. The design requirement of TLD badge system and the dose algorithm were analysed. And the calculation of dose equivalents at interest depths of ICRU Sphere and Water Cube Phantom was performed by using MCNP code. Theoretical computation for the scattering correction factors of the detectors in the KAERI neutron calibration room was done using MCNP code and compared with other results. A Precision Long Counter as a second standard device and a Shadow Cone were specially designed and constructed. (Author).

1757 (LBL–32179) **Estimating the distribution of lifetime cumulative radon exposures for California residents: A brief summary.** Liu, K.S. (California Dept. of Public Health, Berkeley, CA (United States). Air and Industrial Hygiene Lab.); Chang, Y.L.; Hayward, S.B.; Gadgil, A.J.; Nero, A.V. Jr. Lawrence Berkeley Lab., CA (United States). Apr 1992. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-910905–4: 5. international symposium on the natural radiation environment, Salzburg (Austria), 22-28 Sep 1991). Order Number DE93000578. Source: OSTI; NTIS; GPO Dep.

We have used data on residential radon concentrations in California, together with information on California residents' moving histories and time-activity patterns, to estimate the distribution of lifetime cumulative exposures to radon 222. This distribution was constructed using Monte Carlo techniques to simulate the lifetime occupancy histories – and associated radon exposures – of 10,000 California residents. For standard male and female lifespans, the

simulation sampled from transition probability matrices representing changes of residence within and between six regions of California, as well as into and out of the other United States, and then sampled from the appropriate regional (or national) distribution of indoor concentrations. The resulting distribution of lifetime cumulative exposures has a significantly narrower relative width than the distribution of California indoor concentrations, with only a small fraction – less than 0.2% – of the population having lifetime exposures equivalent to living during their lifetimes in a single home with a radon concentration of 148 Bq/m^3 or more.

1758 (NKS–91-8) **The Nordic Nuclear Safety program 1990-1993: Status report for the first half-year 1991.** Nordisk Kernesikkerhedsforskning, Roskilde (Denmark). Aug 1991. 53p. (In Danish, Swedish, Norwegian, English). Order Number DE93603683. Source: OSTI; NTIS; INIS.

The status report concerning the Nordic Nuclear Safety Programme for 1990-1993 contains a summary of the current situation regarding research projects, presented by the four coordinators, and a survey of the related economy. It is stated that all seventeen projects are running satisfactorily and a number of working descriptions have been published. Project leaders work with contracts with consultant firms, research organizations and individuals, contact meetings including lectures and discussions, mini-seminars where participants actually work at the same time, coordination of nationally financed research projects and individual contributions. Problems related to a certain lack of qualified persons for whom it is possible to coordinate this Nordic work with their daily responsibilities have led to delays in relation to the working plans and this has resulted in the fact that not all the grants have been utilized as yet. Sub-programmes are dealt with individually, and lists of publications are presented. (AB) (10 refs.).

1759 (PNL–7877-Rev.1) **National Radiobiology Archives Distributed Access User's Manual, Version 1.1: Revision 1.** Smith, S.K.; Prather, J.C.; Ligotke, E.K.; Watson, C.R. Pacific Northwest Lab., Richland, WA (United States). Jun 1992. 46p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93002438. Source: OSTI; NTIS (documentation only); ESTSC (complete software package), P.O. Box 1020, Oak Ridge, TN 37831-1020; GPO Dep.

This supplement to the NRA Distributed Access User's manual (PNL-7877), November 1991, describes installation and use of Version 1.1 of the software package; this is not a replacement of the previous manual. Version 1.1 of the NRA Distributed Access Package is a maintenance release. It eliminates several bugs, and includes a few new features which are described in this manual. Although the appearance of some menu screens has changed, we are confident that the Version 1.0 User's Manual will provide an adequate introduction to the system. Users who are unfamiliar with Version 1.0 may wish to experiment with that version before moving on to Version 1.1.

1760 (SAND–91-2603C) **Application of RADTRAN to estimation of doses to persons in enclosed spaces.** Neuhauser, K.S. Sandia National Labs., Albuquerque, NM (United States). [1992]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (TTC–1121;CONF-920905–32: 10. international symposium on the packaging and transportation of radioactive materials: PATRAM '92, Yokohama (Japan), 13-18 Sep 1992). Order Number DE93000758. Source: OSTI; NTIS; INIS; GPO Dep.

The RADTRAN computer code for transportation risk analysis can be used to estimate doses to persons in enclosed volumes. This application was developed in response to a need to examine consequences of a hypothetical container leak during accident-free transportation by cargo air. The original problem addressed tritium containers, but the method can be applied to any gaseous or suspended particulate material potentially released in an airplane or other enclosed area (e.g., warehouse) under accident-free conditions. Such leakage can occur during shipment of any radioactive gas or material with a gaseous phase. Atmospheric dispersion is normally modeled in RADTRAN as a series of downwind isopleths each of which is assigned a dilution factor (also known as time-integrated concentration or X/Q value). These values are located in look-up tables in RADTRAN and are normally taken from externally performed Gaussian dispersion calculations. The dilution factors are used to estimate inhalation dose to persons in the specified downwind areas.

1761 (WSRC-MS–92-212) **Radiological risk comparison guidelines.** Hallinan, E.J. (Westinghouse Savannah River Co., Aiken, SC (United States)); Muhlestein, L.D.; Brown, L.F.; Yoder, R.E. Westinghouse Savannah River Co., Aiken, SC (United States). [1992]. 26p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. (CONF-9208117–11: 1992 Energy Facility Contractors Group (EFCOG) safety analysis workshop, Salt Lake City, UT (United States), 11-13 Aug 1992). Order Number DE92040204. Source: OSTI; NTIS; INIS; GPO Dep.

An important aspect of DOE safety analyses is estimating potential accident risk. The estimates are used to: determine if additional controls are needed, identify Safety Class Items, and demonstrate adequate risk reduction. Thus, guidelines are needed to measure comparative risks. The Westinghouse M&O Nuclear Facility Safety Committee and the Safety Envelope Working Group have developed radiological risk guidelines for comparing the risks from individual accident analyses. These guidelines were prepared under contract with the US Department of Energy. These guidelines are based on historical DOE guidelines and current requirements, and satisfy DOE and technical community proposals. for goals that demonstrate acceptable risk. The guidelines consist of a frequency versus consequence curve for credible accidents. Offsite and onsite guidelines are presented. The offsite risk acceptance guidelines are presented in Figure 1. The guidelines are nearly isorisk for anticipated events where impacts are chronic, and provide additional reduction for unlikely events where impacts may be acute and risk uncertainties may be significant. The guidelines are applied to individual release accident scenarios where a discrete frequency and consequence has been estimated. The guideline curves are not to be used for total risk assessments. Common cause events are taken into consideration only for an individual facility. Frequencies outside the guideline range are considered to be local site option (analyst judgement) as far as assessments of risk acceptance are concerned. If the curve is exceeded, then options include either a more detailed analysis or imposing additional preventive or mitigative features. Another presentation discusses implementation in detail. Additional work is needed to provide risk comparison guidelines for releases from multiple facilities and for toxic releases.

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Refer also to citation(s) 72, 1549, 1551, 1575, 1667

1762 (CONF-9208143–1) **Alkylation damage repair in mammalian genomes.** Mitra, S. (Texas Univ. Medical Branch, Galveston, TX (United States). Sealy Center for Molecular Science); Roy, R.; Kim, N.K.; Tano, K.; Ibeanu, G.C.; Dunn, W.C. Oak Ridge National Lab., TN (United States). [1992]. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Alfred Benzon symposium 35 on DNA repair mechanism; Copenhagen (Denmark); 8-13 Aug 1992. Order Number DE93001208. Source: OSTI; NTIS; GPO Dep.

The repair of O^6 -alkylguanine in DNA involves only O^6 -methyltransferase (MGMT) while the repair of N-alkylpurines requires multiple proteins including N-methylpurine-DNA glycosylase (MPG). While the biochemical properties human and mouse MGMTs are very similar, the mouse MPG removes 7-methylguanine more efficiently than the human protein. An increased level of MGMT, without a change in the level of MPG associated with gene amplification, was observed in a mouse cell line resistant to 2-chloroethyl-N-nitrosourea. In contrast, no correlation was observed between MPG level and resistance to methyl methanesulfonate in Chinese hamster ovary (CHO) cells. This result suggests a protein other than MPG limits the repair rate of N-alkylpurine in CHO cells.

1763 (DOE/ER/60674–5) **Base sequence effects on interactions of aromatic mutagens with DNA: Progress report, September 1, 1991–August 31, 1992.** Geacintov, N.E. New York Univ., NY (United States). Dept. of Chemistry. 30 Sep 1992. 19p. Sponsored by USDOE, Washington, DC (United States). DOE

Contract FG02-88ER60674. Order Number DE93001568. Source: OSTI; NTIS; GPO Dep.

The chemical binding of bulky, mutagenic and carcinogenic polynuclear aromatic compounds to certain base-sequences in genomic DNA is known to inhibit DNA replication, and to induce mutations and cancer. In particular, sequences that contain multiple consecutive guanines appear to be hot spots of mutation. The objectives of this research are to determine how the base sequence around the mutagen-modified target bases influences the local DNA conformation and gives rise to mispairing of bases, or deletions, near the lesion. Oligonucleotides containing one, two, or three guanines were synthesized and chemically reacted with the mutagen anti-7,8-dihydroxy-9,10-epoxy-benzo[a]pyrene (BPDE), one of the most mutagenic and tumorigenic metabolites of benzo[a]pyrene. Adducts are formed in which only one of the guanines is modified by trans or cis addition to the exocyclic amino group. The BPDE-oligonucleotides are separated chromatographically, and the site of modification is established by Maxam-Gilbert high resolution gel electrophoresis techniques. The thermodynamic properties of duplexes using complementary, or partially complementary strands were examined. In the latter, the base opposite the modified guanine was varied in order to investigate the probability of mispairing of the modified G with A,T and G. The successful synthesis of stereospecific and site-specific mutagen-oligonucleotide adducts opens new possibilities for correlating adduct structure-biological activity relationships, and thus lead to a better understanding of base-sequence effects in mutagenesis induced by energy-related bulky polynuclear aromatic chemicals.

1764 (KAERI/RR–1055/91) **Biomonitoring of uranium and heavy metal pollution.** Lee, Kang Suk (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Chun, Ki Jung; Kim, Kug Chan; Choi, Yong Ho; Kim, Jin Kyu; Kim, In Gyu; Park, Hyo Kook; Lee, Keun Bae. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Jan 1992. 65p. (In Korean). Order Number DE93605445. Source: OSTI; NTIS (US Sales Only); INIS.

New protein was induced by intraperitoneal injection of uranium. It was purified from liver of carp to which uranium had been at administered 1.5mg/kg fresh for 6 days. The protein was separated by sephadex G-100 and AEAE-Sepharose and characteristics of the metallothionein were not shown by it. It has a molecular weight of 40 KD. Cytosol type superoxide dismutase in carp testis has at least three electrophoretically different forms. Cyanide inhibits the activity of cytosol type superoxide dismutase. When it stored in solution, superoxide dismutase changed into polymeric form which retain its activity. It has been purified by gel permeation, chloroform-ethanol precipitation, and ion exchange column chromatography. (Author).

1765 (KFK–5040) **Progress report on research and development work 1991 of the Institute of Genetics and Toxicology of Fissionable Materials, Karlsruhe Nuclear Research Center.** Kernforschungszentrum Karlsruhe GmbH (Germany). Inst. fuer Genetik und Toxikologie von Spaltstoffen. Mar 1991. 26p. (In German). Order Number DE93720184. Source: OSTI; NTIS (US Sales Only); INIS.

The present annual report describes the results of research work done by the Institute of Genetics and Toxicology of Fissionable Materials (IGT) in 1991. The following eight subjects were dealt with: genetic repair; genetic regulation; biological carcinogenesis; molecular genetics of eukaryontic genes; genetic mouse models for human illnesses; radiation toxicology of actinides; molecular and cellular environmental toxicology, and in vivo fractionation and speciation of actinides. (MG).

1766 (KFK-PEF–90) **Reflection spectra of leaves and needles as basis for the physiological evaluation of tree damage.** Buschmann, C. (Karlsruhe Univ. (T.H.) (Germany). Botanisches Inst. 2); Nagel, E. Kernforschungszentrum Karlsruhe GmbH (Germany). Projekt Europaeisches Forschungszentrum fuer Massnahmen zur Luftreinhaltung (PEF). Jan 1992. 190p. (In German). Contract PEF 87/005/1A;PEF 89/007/1A. Order Number DE93720218. Source: OSTI; NTIS (US Sales Only).

This project aimed to examine whether from reflection signals measured in remote sensing besides discolouring also physiological damages can be detected. By means of a spectrometer (VIRAF) newly developed by us from ca. 2000 leaf samples in each case were measured: Reflection and absorption spectra (400 - 800 nm) as well as fluorescence spectra (650 - 800 nm) and Kautsky-induction-kinetics (at 680 nm). From the reflection spectra the chromaticity coordinates according to CIE 1931 were calculated and the samples were documented by means of a computer-aided video-image-analysis-system. The state of health of a plant can best be determined, if the chlorophyll content of the leaves changes. This is most clearly shown in the shift of the inflection point of the 'red edge' of the reflection spectrum. The composition of the pigment-protein-complexes, the leaf tissue structure and the physiological activity change the reflection to a minor extend. Out of the physiological parameters the chlorophyll fluorescence (detected together with the reflection) affects the reflection most strongly. From the examinations recommendations for practical remote sensing are deduced. (orig.) With 96 figs., 26 tabs., 181 refs.

5604 Other Environmental Pollutant Effects

1767 (ANL/CP–77257) **Effects of maglev-spectrum magnetic field exposure on CEM T-lymphoblastoid human cell growth and differentiation.** Groh, K.R.; Chubb, C.B.; Collart, F.R.; Huberman, E. Argonne National Lab., IL (United States). [1992]. 9p. Sponsored by Department of Transportation, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-920630–2: 1. world congress for electricity and magnetism in biology and medicine, Orlando, FL (United States), 14-29 Jun 1992). Order Number DE92041134. Source: OSTI; NTIS; GPO Dep.

Exposure to magnetic fields similar to those produced by maglev vehicles (combined ac and dc components) was studied for the ability to alter cell growth and chemically induced cellular differentiation processes in cultured human CEM Tlymphoblastoid leukemia cells. A series of continuous and intermittent magnetic field (MF) exposures for varying lengths of time were tested at intensities up to 7-fold greater than that produced by the German TR07 maglev vehicle. Phorbol 12-myristate 13-acetate or mycophenolic acid were used to induce cell differentiation. Changes in cell number, morphology, and fluorescence expression of antigenic markers of differentiation were monitored. The results indicated that maglev-spectrum magnetic field exposures up to 2 gauss had little effect on culture growth or chemically induced cellular differentiation when exposed to maglev-spectrum magnetic fields compared to chemically treated but MF-unexposed controls.

1768 (DOE/BP–92041322) **Seasonal patterns of melatonin, cortisol, and progesterone secretion in female lambs raised beneath a 500-kV transmission lines.** Lee, J.M. Jr. USDOE Bonneville Power Administration, Portland, OR (United States). Jun 1992. 194p. Sponsored by USDOE, Washington, DC (United States). Order Number DE92041322. Source: OSTI; NTIS; GPO Dep.

Thesis submitted by J.M. Lee Jr. to Portland State University, OR.

Although several kinds of biological effects of electric and magnetic fields have been reported from laboratory studies, few have been independently replicated. When this study was being planned, the suppression of nighttime melatonin in rodents was thought to represent one of the strongest known effects of these fields. The effect had been replicated by a single laboratory for 60-Hz electric fields, and by multiple laboratories for d-c magnetic fields. The primary objective of this study was to determine whether the effect of electric and magnetic fields on melatonin would also occur in sheep exposed to a high voltage transmission line. The specific hypothesis tested by this experiment was as follows: The electrical environment produced by a 60-Hz, 500-kV transmission line causes a depression in nocturnal melatonin in chronically exposed female lambs. This may mimic effects of pinealectomy or constant long-day photoperiods, thus delaying the onset of reproductive cycles. Results of the study do not provide evidence to support the hypothesis. Melatonin concentrations in the sheep exposed to the transmission line showed the normal pattern of low daytime and high nighttime serum levels. As compared to the control group, there were no statistically significant group differences in the mean amplitude, phase, or duration of the nighttime melatonin elevation.

1769 (DOE/RA/50219–41) **Investigation of effects of 60-Hz electric and magnetic fields on operant and social behavior and on the neuroendocrine system of nonhuman primates: Quarterly report, Scan and activity data for experiments 4 and 4A, [July 1, 1992–September 30, 1992].** Smith, H.D. Southwest Research Inst., San Antonio, TX (United States). Dept. of Biosciences and Bioengineering. 2 Nov 1992. 130p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-80RA50219. Order Number DE93003124. Source: OSTI; NTIS; GPO Dep.

The objective of this program is to investigate behavioral and neuroendocrine effects associated with exposure to 60-Hz electric and magnetic fields (E/MF), using the baboon surrogate for the human. Baboon social groups were scanned and electronically monitored during Experiments IV and IVA. The social scan, form that the technicians used to identify baboon locations and proximity to other baboons: was used to gain a simple snapshot of the position of the baboons in their cage. The scans were taken hourly every morning and evening for a total of eight scans per side per day. This report covers in detail the scan and activity data-gathering process. A set of appendices is attached which include printouts of the data sets and adjunct material pertinent to interpreting the data. The supporting material is comprised of calendars and listings of major events that occurred during the scan and activity data collection.

1770 (NEI-DK–974) **Traffic at Louisiana: Contributions to the conference.** Hovedstadsraadets Trafikselskab, Valby (Denmark); Trafikministeriet, Copenhagen (Denmark). 1992 96p. (In Danish, Swedish, Norwegian). (CONF-9204202–: Conference on traffic, Humlebaek (Denmark), 10 Apr 1992). Order Number DE93721449. Source: OSTI; NTIS.

A collection of papers contributed to an international conference on traffic management. The overall aim of the conference was to initiate a dialogue beween politicians, researchers and specialists that work within the fields of, or related to, traffic, energy and the environment in order to find solutions to environmental and other problems related to the transport sector, especially in urban areas. (AB).

1771 (NEI-DK–974, pp. 15-19) **Strasbourg's transport policy.** Trautmann, C. Hovedstadsraadets Trafikselskab, Valby (Denmark); Trafikministeriet, Copenhagen (Denmark). 1992. 96p. (In Danish). (CONF-9204202–: Conference on traffic, Humlebaek (Denmark), 10 Apr 1992). In *Traffic at Louisiana: Contributions to the conference.* Order Number DE93721449. Source: OSTI; NTIS.

Strasbourg has undergone extensive development in the field of transport. The main arteries that used to cross Strasbourg's city centre have been cut off. This decision is part of a new transport policy, in which efforts are made to facilitate transport while at the same time allowing for the fact that a city's transport policy has a great influence on the model according to which the city develops. A model based on innovation and on the present transport situation, and one which does away with the old saying that a car is the most perfect, formal and real expression of individual freedom for getting from place to place. In transport terms, the cities of Europe are not at a crossroads where they have to prepare seriously for changes. The future development pattern of our cities will be marked by the measures which for environmental reasons have to be taken in the transport sector. The increasing significance of public transport in this type of city pattern means that urban planning and transport planning need to be integrated, so as to make better room for the fight against trends towards urban decay, dissolution of urban structures and degradation of the life than can be lived in a city. (au).

1772 (NEI-DK–974, pp. 21-25) **Quality of life, environment and transport.** Kickbusch, I. (Livsstil og sundhed, WHO-kontoret (DK)). Hovedstadsraadets Trafikselskab, Valby (Denmark); Trafikministeriet, Copenhagen (Denmark). 1992. 96p. (In Danish). (CONF-9204202–: Conference on traffic, Humlebaek (Denmark), 10 Apr 1992). In *Traffic at Louisiana: Contributions to the conference.* Order Number DE93721449. Source: OSTI; NTIS.

Bearing their global responsibility in mind, European cities will have to introduce and agree upon new forms of social and environmental attitudes, which comprise quality of life, sustainability and human health. Unfortunately, recent surveys have indicated that the Maastrict agreement will lead to increased environmental damage and problems. The solution does not only lie in finding better technological solutions to enable "business as usual" to continue, but also to find an answer to the question "How do we want to live?". In the field of transport the WHO group /EURO core group that consists of 30 Healthy Cities has adopted guidelines for the development of a sound transport policy for urban areas. The guidelines have been made on the basis of an examination of the effects of urban transport on health and the environment - not only with regard to car transport and such effects of it as noise and air pollution, but also in terms of accidents, where most victims are vulnerable groups such as children and elderly people. These guidelines are outlined in more detail in the draft. (au).

1773 (WSRC-RP–92-240) **Response of fish to different simulated rates of water temperature increase.** Wike, L.D.; Tuckfield, R.C. Westinghouse Savannah River Co., Aiken, SC (United States). Aug 1992. 65p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE93000487. Source: OSTI; NTIS; GPO Dep.

We initiated this study to define the limits of effluent-temperature rate increases during reactor restart, which will help minimize fish kills. We constructed an apparatus for exposing fish to various temperature-increase regimens and conducted two experiments based on information from system tests and scoping runs. In the rate experiment, we acclimated the fish to 20°C, and then raised the temperature to 40°C at varying rates. Because scoping runs and literature suggested that acclimation temperature may affect temperature-related mortality, we conducted an acclimation experiment. We acclimated the fish to various temperatures, then raised the temperatures to 39–40°C at a rate of 2°C every 12 hours. Based on the analysis of the data, we recommend temperature-increase rates during reactor restart of 2.5°C every nine hours if ambient water temperatures are over 20°C. If water temperatures are at or below 20°C, we recommend temperature-increase rates of 2.5°C every 12 hours. No regulation of temperature is required after effluent temperatures reach 40°C. We recommend further studies, including expanded testing with the simulation system and behavioral and bioenergetic investigations that may further refine acceptable rates of effluent-temperature increases.

57 HEALTH AND SAFETY

Refer also to citation(s) 298, 299

5701 Real Accidents

Refer also to citation(s) 1471, 2492

58 GEOSCIENCES

Refer also to citation(s) 97, 98, 99, 142, 399, 1156, 1488, 1555, 1601

1774 (DOE/ER/13414–T1) **Activity composition relationships in silicate melts: Final report.** Glazner, A.F. North Carolina Univ., Chapel Hill, NC (United States). [1990]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-85ER13414. Order Number DE93000931. Source: OSTI; NTIS; GPO Dep.

Equipment progress include furnace construction and electron microprobe installation. The following studies are underway: phase equilibria along basalt-rhyolite mixing line (olivine crystallization from natural silicic andensites, distribution of Fe and Mg between olivine and liquid, dist. of Ca and Na between plagioclase and liquid), enthalpy-composition relations in magmas (bulk heat capacity of alkali basalt), density model for magma ascent and contamination, thermobarometry in igneous systems (olivine/plagioclase phenocryst growth in Quat. basalt), high-pressure phase equilibria of alkali basalt, basalt-quartz mixing experiments, phase equilibria of East African basalts, and granitic minerals in mafic magma. (DLC)

1775 (DOE/ER/14079–19) **Migration error in transversely isotropic media with linear velocity variation in depth.** Larner, K.; Cohen, J.K. Colorado School of Mines, Golden, CO (United States). Center for Wave Phenomena. [1992]. 32p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-89ER14079. (CWP–118R). Order Number DE93000386. Source: OSTI; NTIS; GPO Dep.

Given the sensitivity of imaging accuracy to the velocity used in migration, migration founded (as in practice) on the erroneous assumption that a medium is isotropic can be expected to be inaccurate for steep reflectors. Here, we estimate errors in interpreted reflection time and lateral position as a function of reflector dip for transversely isotropic models in which the axis of symmetry is vertical and the medium velocity varies linearly with depth. We limit consideration to media in which ratios of the various elastic moduli are independent of depth. Tests with reflector dips up to 120 degrees on a variety of anisotropic media show errors that axe tens of wavelengths for dips beyond 90 degrees when the medium (unrealistically) is homogeneous. For a given anisotropy, the errors are smaller for inhomogeneous media; the larger the velocity gradient, the smaller the errors. For gradients that are representative of the subsurface, lateral-position errors tend to be minor for dips less than about 60 degrees, growing to two to five wavelengths as dip passes beyond 90 degrees. These errors depend on reflector depth and average velocity to the reflector only through their ratio, i.e., migrated reflection time. Migration error, which is found to be unrelated to the ratio of horizontal to vertical velocity, is such that reflections with later migrated reflection times tend to be more severely over-migrated than are those with earlier ones. Over a large range of dips, migration errors that arise when anisotropy is ignored but inhomogeneity is honored tend to be considerably smaller than those encountered when inhomogeneity is ignored in migrating data from isotropic, inhomogeneous media.

1776 (DOE/ER/14079–20) **Dip-moveout error in transversely isotropic media with linear velocity variation in depth.** Larner, K. Colorado School of Mines, Golden, CO (United States). Center for Wave Phenomena. [1992]. 24p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-89ER14079. (CWP–119R). Order Number DE93000640. Source: OSTI; NTIS; GPO Dep.

Levin (1990) modeled the moveout, within Common-midpoint (CMP) gathers, of reflections from plane-dipping reflectors beneath homogeneous, transversely isotropic media. For some media, when the axis of symmetry for the anisotropy was vertical, he found departures in stacking velocity from predictions based upon the familiar cosine-of-dip correction for isotropic media. Here, I do similar tests, again with transversely isotropic models with vertical axis of symmetry, but now allowing the medium velocity to vary linearly with depth. Results for the same four anisotropic media studied by Levin show behavior of dip-corrected stacking velocity with reflector dip that, for all velocity gradients considered, differs little from that for the counterpart homogeneous media. As with isotropic media, traveltimes in an inhomogeneous, transversely isotropic medium can be modeled adequately with a homogeneous model with vertical velocity equal to the vertical rms velocity of the inhomogeneous medium. In practice, dip-moveout (DMO) is based on the assumption that either the medium is homogeneous or its velocity varies with depth, but in both cases isotropy is assumed. It turns out that for only one of the transversely isotropic media considered here –shale-limestone – would v(z) DMO fail to give an adequate correction within CMP gathers. For the shale-limestone, fortuitously the constant-velocity DMO gives a better moveout correction than does the v(z) DMO.

1777 (DOE/ER/14153–2) **Reactive fluid flow models and applications to diagenesis, mineral deposits and crustal rocks: Progress report.** Lasaga, A.C.; Rye, D.M. Yale Univ., New Haven, CT (United States). [1992]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-90ER14153. Order Number DE93002097. Source: OSTI; NTIS; GPO Dep.

This project is obtaining new results and developing new techniques along three directions: (a) experimental studies of water-rock reactions (b) theoretical modeling of coupled fluid flow-chemical reactions and (c) isotopic measurements of both regional isotopic compositions as well as isotopic zoning within individual mineral grains. An important part of the project is the integration of all three approaches into a concerted effort aimed at new understanding of the behavior of fluids and their chemical reactions with minerals in the crust. The experimental work pioneered in our laboratories has produced several startling results on the kinetic rate laws of silicate-water reactions. The approach to equilibrium has been shown to follow a non-linear path in rate constant-free energy space. This behavior is quite distinct from most work done by geochemists on modeling silicate behavior in diagenesis, weathering, hydrothermal systems or environmental models. The work to date has involved albite, kaolinite and gibbsite, which together with silica would comprise a kinetic "granite system prototype". The theoretical modeling has produced a state-of-the-art computer code that can efficiently handle dozens of chemical species, many mineral reactions and variations of fluid flow properties and temperature in both one and two dimensions. In addition the code can now treat oxidation-reduction reactions and isotopic exchange between fluids and minerals. The main thrust of the theoretical modeling has been to develop further the differences between equilibrium, steady state, and non-steady-state behavior of the chemical evolution of open fluid-rock systems. These differences have not been fully appreciated in previous models.

1778 (LBL–32195) **Brief guide to the MINC-method for modeling flow and transport in fractured media.** Pruess, K. Lawrence Berkeley Lab., CA (United States). May 1992. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. Order Number DE93001520. Source: OSTI; NTIS; GPO Dep.

MINC stands for "Multiple INteracting continua." It is an approximate method for modeling fluid and heat flow in fractured- porous media, developed by Pruess and Narasimhan (1982, 1985) at the Lawrence Berkeley Laboratory. The method is applicable to flow processes in which an important aspect is the exchange of fluid, heat, or chemical species between fractures and unfractured rock. Examples include production and injection operations in fractured geothermal reservoirs, water-flooding, steamflooding, and other methods for enhanced oil recovery from fractured reservoirs, as well as chemical transport and contaminant migration in fractured rock. MINC can only be applied to media in which the fractures are sufficiently well connected so that a continuum treatment of flow in the fracture network can be made.

1779 (NEI-DK–966) **Acquisition project: Final report, part 1.** Vejlby Hansen, K. Oedegaard og Danneskiold-Samsoee ApS, Copenhagen (Denmark). Sep 1991 45p. Contract ENS-1313/90-0002. Order Number DE93721412. Source: OSTI; NTIS.

EFP-90.

An introduction to marine seismic acquisition which mainly describes the acquisition geometry with special attention to the CMP (Common MidPoint)-gather geometry. The moveout correction, which is used to correct the recorded signals to zero offset signals, is derived for several subsurface models and the data sorting and stacking are also deduced. The CMP-gather configuration is of interest due to the improvement of the signal-to-noise ratio of the recorded data and the possiblity of subsurface layer velocity estimation. It is concluded that to describe arbitrary subsurface models ray tracing should be used in relation to the moveout correction and stacking. A simple ray tracing principle is deduced. The assumed subsurface model is characterized by homogeneous layers having constant velocity and straight lines as interfaces. The difference between the original and the new approach is that the previous one assumes that the optical acquisition parameters are a point in a mult-dimensional space while the new approach assumes that the optimal parameter values are intervals and only finds the limits of the intervals. It is based on accuracy of estimated layer velocities, signal-to-noise ratio and separation of the receiver ghost. The required layer velocity accuracy is translated by use of a two dimensional sampling to a required offset and hydrophone group distance. The required signal-to-noise ratio is used to determine the necessary number of folds. The elimination of the receiver ghost is used to determine the required depth of the streamer from the surface. (AB).

1780 (NEI-DK–967) **Acquisition project: Final report, part 2.** Bolding Rasmussen, K. Oedegaard og Danneskiold-Samsoee ApS, Copenhagen (Denmark). May 1992 22p. Contract ENS-1313/90-0002. Order Number DE93721413. Source: OSTI; NTIS.

EFP-90.

A feasible and sound approach to optimization of reflection seismic acquisition parameters is developed. A computer programme is developed which can assist in using this approach. Given the desired information contents in the data, measured by the so-called data quality paramaters, the computer program calculates the minimum required acquisition parameters. The approach is based entirely on mathematical models. This means that it is reasonable to expect that the approach will lead to usable acquisition parameter setups also in new exploration areas. The approach is based on closed form equations and a fully integrated ray tracer but it is simple to extend it with more accurate relations, e.g. a full wave equation based forward modelling. (Author).

66 PHYSICS

1781 (INIS-mf–13349) **Abstract of articles from Iran's physics conference.** Mirzabeygi, J. (ed.). Iranian Physics Society, Teheran (Iran, Islamic Republic of). 1991 53p. (In Persian). (CONF-9109417–: Iran's physics conference, Isfahan (Iran, Islamic Republic of), 10 Sep 1991). Order Number DE93000811. Source: OSTI; NTIS (US Sales Only); INIS.

Individual papers in scope for the database are processed separately.

6610 General Physics

1782 (IC–92/58) **On the estimates to measure Hawking effect and Unruh effect in the laboratory.** Rosu, H. International Centre for Theoretical Physics, Trieste (Italy). Apr 1992. 5p. Order Number DE93606027. Source: OSTI; NTIS (US Sales Only); INIS.

A comparison between the proposals made to measure Hawking-like effects and Unruh effect in the laboratory is given at the level of their estimates. No satisfactory scheme exists as yet for their detection. (author). 12 refs.

1783 (INIS-mf–13358) **Israel physical society 1992 annual meeting: Program and abstracts.** Bulletin of the Israel physics society. Imry, Yoseph. Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Physics. 1992 169p. (CONF-9204195–: 1992 Israel Physical Society annual meeting, Rehovot (Israel), 15 Apr 1992). Order Number DE93604079. Source: OSTI; NTIS (US Sales Only); INIS.

The publication presents investigations in various fields of the physics science including contributions to environment and life sciences.

1784 (WIS-PH–92-38) **Topology and statistics in zero dimensions.** Aneziris, Charilaos. Weizmann Inst. of Science, Rehovoth (Israel). May 1992. 26p. Order Number DE93604080. Source: OSTI; NTIS (US Sales Only); INIS.

It has been suggested that space-time may be intrinsically not continuous, but discrete. Here we review some topological notions of discrete manifolds, in particular ones made out of final number of points, and discuss the possibilties for statistics in such spaces. (author).

6611 Classical and Quantum Mechanics

Refer also to citation(s) 1832, 1842, 1861, 1905

1785 (IC–92/143) **Multiparametric quantum symplectic phase space.** Parashar, P. (International Centre for Theoretical Physics, Trieste (Italy)); Soni, S.K. International Centre for Theoretical Physics, Trieste (Italy). Jul 1992. 11p. Order Number DE93604081. Source: OSTI; NTIS (US Sales Only); INIS.

We formulate a consistent multiparametric differential calculus on the quadratic coordinate algebra of the quantum vector space and use this as a tool to obtain a deformation of the associated symplectic phase space involving n(n-1)/2+1 deformation parameters. A consistent calculus on the relation subspace is also constructed. This is achieved with the help of a restricted ansatz and solving the consistency conditions to directly arrive at the main commutation structures without any reference to the R-matrix. However, the non-standard R-matrices for $GL_{r,s|}(n)$ and $Sp_{r,s|}(2n)$ can be easily read off from the commutation relations involving coordinates and derivatives. (author). 9 refs.

1786 (IC–92/158) **In what sense the canonical perturbation theory is gauge-invariant.** Chen, C.Y. International Centre for Theoretical Physics, Trieste (Italy). Jul 1992. 11p. Order Number DE93604082. Source: OSTI; NTIS (US Sales Only); INIS.

It is shown that the time-dependent canonical perturbation theory in classical mechanics has unsatisfactory features when dealing with electromagnetic perturbed fields (the perturbed vector potential A-tilde $\neq 0$). As a numerical apparatus, the theory relates to gauge-dependent vectors larger than expected. As an analytic apparatus, the theory is involved in unphysical concepts and yields inherently non-gauge-invariant formalisms. By defining the root cause of the problem, an alternative approach is accordingly introduced. (author). 8 refs, 2 figs.

1787 (IC–92/169) **Formulation of wave mechanics without the Planck constant (h/2π).** Barut, A.O. International Centre for Theoretical Physics, Trieste (Italy). Jul 1992. 4p. Order Number DE93604083. Source: OSTI; NTIS (US Sales Only); INIS.

Quantum mechanics can be formulated without the parameters (h/2π), m and e as a pure "wave theory" in terms of the frequencies alone. This is more directly related to experiments where one measures frequency differences rather than energies. Different quantum systems are then characterized by an intrinsic proper frequency ω_0. (author). 3 refs.

1788 (IC–92/172) **The Hermite-like description of two-magnon eigenvectors of 1D Heisenberg Hamiltonian with elliptic exchange is complete.** Inozemtsev, V.I. International Centre for Theoretical Physics, Trieste (Italy). Jul 1992. 6p. Order Number DE93606029. Source: OSTI; NTIS (US Sales Only); INIS.

The problem of describing all N(N-1)/2 states in two-magnon sector of 1D periodic S = 1/2 chain with the Hamiltonian $H = -1/2\Sigma^{N}_{j,l}\rho(j - l)(\sigma_j\sigma_l-1)/2$ of spin interaction via elliptic Weierstrass ρ function is investigated. It is proved that the set of eigenvectors having Hermite-like form is complete. (author). 9 refs.

1789 (IC–92/177) **On an inequality for non-normal operators.** Duggal, B.P. International Centre for Theoretical Physics, Trieste (Italy). Jul 1992. 5p. Order Number DE93604084. Source: OSTI; NTIS (US Sales Only); INIS.

Starting from the inequality proved by Takayuki Furuta for a dominant operator A on a complex Hilbert space H, which extends to all operators such that the pure part of A has empty point spectrum, it is shown that if A is a contraction (on a separable complex Hilbert space) with simple eigenvalues and C_0 completely non-unitary part, and if $(1-A^*A)^{1/2}$ is of Hilbert-Schmidt class, then the said inequality holds for A. 8 refs.

1790 (INIS-BR–2933, pp. 260) **Bateman Hamiltonian and squeezing - II.** Briro, A.L. de (Pernambuco Univ., Recife, PE (Brazil). Dept. de Fisica); Baseia, B. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. HAMILTONIANS/ electromagnetic fields; HAMILTONIANS; MATHEMATICAL OPERATORS

1791 (INIS-BR–2933, pp. 262) **Mixture of two quasi degenerate waves in saturable absorbers.** Zilio, S.C. (Paraiba Univ., Joao Pessoa, PB (Brazil)); Penaforte, J.C.; Gouveia, E.A.; Bell, M.J.V. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. BEAM DYNAMICS/diffraction models; ABSORPTION; DIFFRACTION GRATINGS; WAVE FORMS

1792 (INIS-BR–2933, pp. 277) **Non-diagonal quasi-probabilities for S order.** Oliveira, F.A.M. de (Rio Grande do Norte Univ., Natal, RN (Brazil). Dept. de Fisica). Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. QUANTUM MECHANICS/phase space; DENSITY; DIFFERENTIAL EQUATIONS; FOKKER-PLANCK EQUATION; QUANTUM OPERATORS

1793 (INIS-BR–2933, pp. 330) **EPRB correlation for light polarization.** Mizrahi, S. (Sao Carlos Univ., SP (Brazil). Dept. de Fisica); Moussa, M.H.Y. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. VISIBLE RADIATION/polarization; CLASSICAL MECHANICS; PHOTONS; POLARIZATION

1794 (INIS-mf–13349, pp. 17) **Electron behavior in presence of toroidal magnetic field, quantum invariance formulation.** Golshan, M.M. (Shiraz Univ., (Iran, Islamic Republic of) Physics Div.); Jalali Roodsar, A.A. Iranian Physics Society, Teheran (Iran, Islamic Republic of). 1991. 53p. (In Persian). (CONF-9109417–: Iran's physics conference, Isfahan (Iran, Islamic Republic of), 10 Sep 1991). In *Abstract of articles from Iran's physics conference.* Order Number DE93000811. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. ELECTRONS/magnetic fields; QUANTUM MECHANICS; EIGENVALUES; ELECTRONS; HAMILTONIANS; INVARIANCE PRINCIPLES

1795 (INP–1538/PH) **On the new notion of mass in classical mechanics.** Horzela, A. (Institute of Nuclear Physics, Cracow (Poland)); Kapuscik, E.; Kempczynski, J. Institute of Nuclear Physics, Cracow (Poland). Jan 1991. 8p. Order Number DE93604090. Source: OSTI; NTIS (US Sales Only); INIS.

A new concept of mass connected with the Galilean transformation rules of momenta and energy is introduced. It is shown that the Galilean mass does not have to be equal to the inertial mass of a particle. (author).

1796 (IYaF–91-83) **Chaotic quantum systems.** Chirikov, B.V. AN SSSR, Novosibirsk (Russian Federation). Inst. Yadernoj Fiziki. 1991. 58p. Order Number DE93606030. Source: OSTI; NTIS (US Sales Only); INIS.

Lecture presented to 10. International Congress on Mathematical Physics, Leipzig, 1991.

The overview of recent developments in the theory of quantum chaos is presented with the special emphasis on a number of unsolved problems and current apparent contradictions. The relation between dynamical quantum chaos and statistical random matrix theory is discussed. 97 refs.

1797 (IYaF–91-97) **Scaling properties of localized quantum chaos.** Izrailev, F.M. AN SSSR, Novosibirsk (Russian Federation). Inst. Yadernoj Fiziki. 1991. 23p. Order Number DE93606031. Source: OSTI; NTIS (US Sales Only); INIS.

Statistical properties of spectra and eigenfunctions are studied for the model of quantum chaos in the presence of dynamical localization. The main attention is paid to the scaling properties of localization length and level spacing distribution in the intermediate region between Poissonian and Wigner-Dyson statistics. It is shown that main features of such localized quantum chaos are well described by the introduced ensemble of band random matrices. 28 refs.; 7 figs.

1798 (JINR-D–2-91-436) **Modern approach to relativity theory (radar formulation).** Strel'tsov, V.N. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of High Energy. 1991. 7p. Order Number DE93606032. Source: OSTI; NTIS (US Sales Only); INIS.

The main peculiarities of the radar formulation of the relativity theory are presented. This formulation operates with the retarded (light) distances and relativistic or radar length introduced on their basis. 21 refs.; 1 tab.

1799 (JINR-E–2-90-550) **Quantum mechanics of toroidal anions.** Afanas'ev, G.N. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Theoretical Physics. 1990. 22p. Order Number DE93606033. Source: OSTI; NTIS (US Sales Only); INIS.

We consider a toroidal solenoid with an electric charge attached to it. It turns out that statistical properties of the wave function describing interacting toroidal anions depend on both their relative position and orientation. The influence of the particular gauge choice on the exchange properties of the wave function is studied. 30 refs.; 6 figs.

1800 (JINR-E–2-91-133) **On two-dimensional quasiclassics.** Balandin, M.P.; Zastavenko, L.G. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Theoretical Physics. 1991. 11p. Order Number DE93606034. Source: OSTI; NTIS (US Sales Only); INIS.

Quasiclassical limit of the two-dimensional Schroedinger equation is studied. Potential is supposed to weakly depend on the azimuthal angle. Behaviour of the quasiclassical wave function in a vicinity of turning curve is considered. 5 refs.

1801 (JINR-E–2-91-312) **Numerical investigation of Tonomura experiments.** Afanas'ev, G.N.; Shilov, V.M. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Theoretical Physics. 1991. 12p. Order Number DE93606035. Source: OSTI; NTIS (US Sales Only); INIS.

Submitted to proc. R. Soc. London, Ser. A Math. Phys.

The quantitative theoretical analysis of Tonomura experiments testing the existence of the Aharonov-Bohm effect is given. The intensities of scattered electrons are computed for different values of the magnetic flux and positions of the observation plane. 24 refs.; 10 figs.

1802 (JINR-E–2-91-462) **Phase space representations for spin 2.** Polubarinov, I.V. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Theoretical Physics. 1991. 24p. Order Number DE93606036. Source: OSTI; NTIS (US Sales Only); INIS.

Phase space representations for spin 2 are introduced. Main tool is a completeness relation written in different forms: in terms of the density matrices of spin states and in other relative forms. The corresponding quantum analogs of the Bell inequality are obtained. 18 refs.; 2 tabs.

1803 (JINR-E–2-91-477) **Classical mechanics of confined particles.** Kapuscik, E.; Horzela, A. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Theoretical Physics. 1991. 10p. Order Number DE93606037. Source: OSTI; NTIS (US Sales Only); INIS.

An alternative picture of classical many body mechanics is proposed. The theory is complete and allows to determine the trajectories of each particle. 4 refs.

1804 (JINR-E–5-91-385) **Quantum states of the photon phase operator.** Popov, V.N. (AN SSSR, Leningrad (Russian Federation). Matematicheskij Inst.); Yarunin, V.S. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Theoretical Physics. 1991. 6p. Order Number DE93606038. Source: OSTI; NTIS (US Sales Only); INIS.

A short review is given for two different photon phase states in quantum optics, introduced by Popov, Yarunin (1973) and Barnet, Pegg (1989). The difference between them is analyzed and the second construction (1989) is shown to be a private case of the first one. 8 refs.

1805 (JINR-E–5-91-485) **On the impossibility of creating the quantum correlations with computer.** Vinduska, M. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of

Nuclear Reactions. 1991. 15p. Order Number DE93606039. Source: OSTI; NTIS (US Sales Only); INIS.

It is indicated that Feynman's proof about the impossibility of creating the quantum correlations with computers does not hold if the general transformations of the probability measure of the treated systems do not for a group. In the paper the consequences of this fact are considered in relation to the Bell inequalities and to the models of relative probability measure on the concave surfaces. 5 refs.; 4 figs.; 2 tabs.

1806 (JINR-R–2-91-403) **On the method of determining relations.** Mel'nikov, V.K. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Theoretical Physics. 1991. 8p. (In Russian). Order Number DE93606041. Source: OSTI; NTIS (US Sales Only); INIS.

Submitted to the 7-th conference on nonlinear evolution equations and dynamic systems, Italy, June, 1991.

It is shown that a multicomponent nonlinear Schroedinger equation with a source can be derived by the method of determining relations thus making it possible to apply the inverse scattering method to analyze this equation. However, the system of evolution equations for the scattering data turned out to be nonlinear. An operator relation of the Lax type is also derived which holds due to this equation. However, this operator relation does not uniquely determine this equation and does not guarantee independence of time of the discrete spectrum of the corresponding linear operator. 7 refs.

1807 (JINR-R–2-91-460) **Equation of motion of four degree for tetranions.** Yamaleev, R.M. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Computing Techniques and Automation. 1991. 14p. (In Russian). Order Number DE93606042. Source: OSTI; NTIS (US Sales Only); INIS.

The generalization of the Dirac equation for the case of four degree polynomial relashioship between energy and momentum is suggested. By the way of change the complex wave function with the wave function on multicomplex numbers of four degree provides the unique form of polynomials. The particles with similar properties are called tetranions. 6 refs.

1808 (JINR-R–4-91-440) **Elements of the theory of resonance management of the quantum scattering: Simple models clarifying the general case.** Zakhar'ev, B.N. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Theoretical Physics. 1991. 19p. (In Russian). Order Number DE93606043. Source: OSTI; NTIS (US Sales Only); INIS.

The present paper continues a set of papers on quantum engineering. It is shown on the model examples that the structure of the target provides the growth of the phase shift by several π. The models with potential barriers concentrated at a separate points and one- and multi-channel targets are considered. 12 refs.; 11 figs.

1809 (JINR-R–4-91-453) **A new view on the machinery of generation of spectral zones: The discrete and the ordinary quantum mechanics.** Zastavenko, L.G.; Zakhar'ev, B.N. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Theoretical Physics. 1991. 18p. (In Russian). Order Number DE93606044. Source: OSTI; NTIS (US Sales Only); INIS.

The instructive comparison of the creation of allowed and forbidden zones by the simplest models with periodical delta-type potentials and with the free wave motion along the descrete variable is presented. It is shown how to connect spectral parameters of the infinitely deep potential well of the finite widths with the properties of the motion in the periodical potentials. 24 refs.; 5 figs.

1810 (JINR-R–17-91-446) **Quantum-kinetic Green function and macroscopic wave function.** Lushchikov, V.I.; Savel'eva, A.E. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems. 1991. 16p. (In Russian). Order Number DE93606040. Source: OSTI; NTIS (US Sales Only); INIS.

On the basis of Schroedinger equation, generalized to six-dimensional phase space and brought into correspondence with the hypothesis of the particle interaction with vacuum, the equations for quantum-kinetic Green function and macroscopic wave function are proposed. The quantum-kinetic Green function is found, which takes into account both the motion properties of a separate particle and the collective characteristics of the system. 4 refs.

1811 (WIS-PH–92-45) **Regular and chaotic motion of two dimensional electrons in a strong magnetic field.** Bar-Lev, Oded; Levit, Shimon. Weizmann Inst. of Science, Rehovoth (Israel). May 1992. 14p. Order Number DE93604091. Source: OSTI; NTIS (US Sales Only); INIS.

For two dimensional system of electrons in a strong magnetic field a standard approximation is the projection on a single Landau level. The resulting Hamiltonian is commonly treated semiclassically. An important element in applying the semiclassical approximation is the integrability of the corresponding classical system. We discuss the relevant integrability conditions and give a simple example of non-integrable system-two interacting electrons in the presence of two impurities-which exhibits a coexistence of regular and chaotic classical motions. Since the inverse of the magnetic field plays the role of the Planck constant in these problems, one has the opportunity to control the 'closeness' of chaotic physical systems to the classical limit. (author).

6612 Techniques of General Use in Physics

Refer also to citation(s) 1361, 1835, 1990, 2088, 2089

1812 (ANL/CP–76580) **Radioactive target and source development at Argonne National Laboratory.** Greene, J.P.; Ahmad, I.; Thomas, G.E. Argonne National Lab., IL (United States). [1992]. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-920933–3: 16. world conference of the International Nuclear Target Development Society: nuclear target preparation, Legnaro (Italy), 21-25 Sep 1992). Order Number DE93000614. Source: OSTI; NTIS; INIS; GPO Dep.

An increased demand for low-level radioactive targets has created the need for a laboratory dedicated to the production of these foils. A description is given of the radioactive target produced as well as source development work being performed at the Physics Division target facility of Argonne National Laboratory (ANL). Highlights include equipment used and the techniques employed. In addition, some examples of recent source preparation are given as well as work currently in progress.

1813 (CEA-CONF–11032) **Closed cycle liquid helium refrigerators.** Claudet, G.; Lagnier, R.; Ravex, A. CEA Centre d'Etudes de Grenoble, 38 (France). Dept. de Recherche Fondamentale sur la Matiere Condensee. 1992. 4p. (CONF-9206300–: International Conference on Institute of Refrigeration, Kiev (USSR), 8-12 Jun 1992). Order Number DE93721141. Source: OSTI; NTIS (US Sales Only); INIS.

We have developed closed cycle liquid helium refrigerators using a Joule Thomson circuit precooled by commercially available two staged Gifford Mac Mahon cryocoolers. The Joule Thomson counterflow heat exchangers are modular and have been thermohydraulically characterized. Fully automatic cool down and operation are achieved by two pneumatically driven by pass and expansion valves. Several apparatus have been built or are under assembly with cooling power ranging from 100 mW up to 5 Watt, for temperature ranging from 2.8 K up to 4.5 K. A trouble free operation with several warm up and cool down cycles has been proven over 7000 hours.

1814 (INIS-BR–2933, pp. 267) **Production of monoenergetic atomic beams using radiation pressure.** Marcassa, L.G. (Sao Paulo Univ., Sao Carlos, SP (Brazil). Inst. de Fisica e Quimica); Colussi, V.C.; Zilio, S.C.; Bagnato, V.S. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. ATOMIC BEAMS/beam production; DISPERSION RELATIONS; LASER RADIATION; MAGNETIC FIELDS; SODIUM; VELOCITY; ZEEMAN EFFECT

1815 (INIS-BR–2933, pp. 269) **Study to obtain monoenergetic beam by numerical simulation non-degenerated photons.** Faria, C.F.M. (Sao Paulo Univ., Sao Carlos, SP (Brazil). Inst. de Fisica e Quimica); Napolitano, R.J.; Bagnato, V.S. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. ATOMIC BEAMS/beam production; LASER RADIATION; MAGNETIC FIELDS; NUMERICAL SOLUTION; SODIUM; ZEEMAN EFFECT

1816 (IPNO-DRE–91-30) **New projectiles: multicharged metal clusters and biopolymers.** Della-Negra, S.; Gardes, D.; Le Beyec, Y.; Waast, B. Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire. 1991. 19p. (In French). Order Number DE93721030. Source: OSTI; NTIS (US Sales Only); INIS.

Metal clusters and molecules are the one mean to realize simultaneous impacts of several atoms on a reduced surface(≈100A). The interaction characteristics is the non-linearity of energy deposition; the perturbation that the cluster produces, is above than the sum of the perturbation induced by its components, taken separately. The purpose of ORION project is to accelerate these new projectiles at ORSAY Tandem. The considered mass range is from 100 Daltons to 100 000 Daltons and energy range from MeV to GeV.

6613 Other Aspects of Physical Science

Refer also to citation(s) 377, 870, 1160, 1229, 1843, 2304

1817 (DOE/ER/40606–2) **Nuclear physics and astrophysics: Progress report, July 15, 1991–June 15, 1992.** Schramm, D.N.; Olinto, A.V. Chicago Univ., IL (United States). Dept. of Astronomy and Astrophysics. Sep 1992. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-91ER40606. Order Number DE93002042. Source: OSTI; NTIS; INIS; GPO Dep.

We have investigated a variety of research topics on the interface of nuclear physics and astrophysics during the past year. We have continued our study of dihyperon states in dense matter and have started to make a connection between their properties in the core of neutron stars with the ongoing experimental searches at Brookhaven National Laboratory. We started to build a scenario for the origin of gamma-ray bursts using the conversion of neutron stars to strange stars close to an active galactic nucleous. We have been reconsidering the constraints due to neutron star cooling rates on the equation of state for high density matter in the light, of recent findings which show that the faster direct Urca cooling process is possible for a range of nuclear compositions. We have developed a model for the formation of primordial magnetic fields due to the dynamics of the quark-hadron phase transition. Encouraged by the most recent observational developments, we have investigated the possible origin of the boron and beryllium abundances. We have greatly improved the calculations of the primordial abundances of these elements I>y augmenting the reaction networks and by updating the most recent experimental nuclear reaction rates. Our calculations have shown that the primordial abundances are much higher than previously thought but that the observed abundances cannot be explained by primordial sources alone. We have also studied the origin of the boron and beryllium abundances due to cosmic ray spallation. Finally, we have continued to address the solar neutrino problem by investigating the impact of astrophysical uncertainties on the MSW solution for a full three-family treatment of MSW mixing.

1818 (DOE/ER/40682–18) **Non-Abelian soft boson phase transitions and large scale structure.** Holman, R. (Carnegie-Mellon Univ., Pittsburgh, PA (United States). Dept. of Physics); Singh, A. Carnegie-Mellon Univ., Pittsburgh, PA (United States). Dept. of Physics. 20 Apr 1992. 10p. Sponsored by USDOE, Washington, DC (United States); National Science Foundation, Washington, DC (United States). DOE Contract FG02-91ER40682;AC02-76ER03066. Grant PHY89-04035. (CMU-HEP–92-06;NSF-ITP–92-19). Order Number DE93002649. Source: OSTI; NTIS; INIS; GPO Dep.

A new class of models with Pseudo-Nambu-Goldstone bosons (PNGB's) is constructed using a non-Abelian symmetry in the right handed Majorana neutrino sector of see-saw neutrino mass models. The phase structure of these models is examined both at zero and non-zero temperatures, with particular emphasis on their phase transition characteristics. We find that the vacuum manifold of these models exhibits a rich structure in terms of possible topological defects, and we argue that these models may have applications to late time phase transition theories of structure formation.

1819 (IC–92/174) **Chirality, phase transitions and their induction in amino acids.** Salam, A. International Centre for Theoretical Physics, Trieste (Italy). Apr 1991. 13p. Order Number DE93604117. Source: OSTI; NTIS (US Sales Only); INIS.

"Atoms such as carbon, oxygen, nitrogen and hydrogen, the major constituents of biological molecules, are less than 0.4 nm in diameter... The behaviour of small molecules is a reflection of the intrinsic properties of the constituent atoms. Hence it might be expected that the behaviour of large macromolecules can be explained by a knowledge of atomic properties. Since organelles, whole cells and organisms are essentially macromolecular assemblies, it may be possible in time to derive an atomic theory of life" (Rees and Sternberg). It has been suggested that chirality among the twenty amino acids which make up the proteins may be a consequence of a phase transition which is analogous to that due to BCS superconductivity. We explore these ideas in this paper and show, following Lee and Drell, that a crucial form for the transition temperature T_c involves dynamical symmetry breaking. The t-quarks or supersymmetry (or something similar which ensures a heavy mass) appear to be essential if such mechanisms are to hold. (author). 12 refs, 1 fig., 1 tab.

1820 (INIS-BR–2933, pp. 260) **Effect of photon statistics on collapse phenomenon and reactivation in three-level atom.** Andrade Neto, M.A. (Universidade Estadual de Campinas, SP (Brazil)); Roversi, J.A.; Sharma, M.P. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. PHOTONS/bose-einstein statistics; ATOMIC MODELS; BLACKBODY RADIATION; COUPLING CONSTANTS; PHOTONS; TIME DEPENDENCE

1821 (INIS-BR–2933, pp. 299) **Iterative method for inversion of Bloch equation.** Nascimento, G.C. do (Pernambuco Univ., Recife, PE (Brazil). Dept. de Fisica). Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. BLOCH EQUATIONS/iterative methods; BLOCH EQUATIONS/nmr imaging; MAGNETIZATION/bloch equations; MAGNETIZATION; PULSES

1822 (INIS-BR–2933, pp. 305) **Contribution of intermolecular interactions in electric field gradient.** Rabbani, S.R. (Sao Paulo Univ., SP (Brazil). Inst. de Fisica); Isotani, S.; Pontuschka, W.M.; Mizukami, A. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. INTERMOLECULAR FORCES/electric fields; ALUMINIUM OXIDES; DEUTERIUM; GRAIN SIZE; NITROGEN; NUCLEAR QUADRUPOLE RESONANCE; SODIUM SULFATES; SODIUM 25; ZEOLITES

1823 (INIS-BR–2934, pp. 294-297) **Limiting fragmentation and the vertical muons in hadron showers.** Bellandi Filho, J.

(Universidade Estadual de Campinas, SP (Brazil). Inst. de Fisica); Brunetto, S.Q.; Mundin, L.M.; Alves, M.A.; Covolan, R.J.M.; Padua, A.B. de. Sociedade Brasileira de Fisica, Rio de Janeiro, RJ (Brazil). 1989. 350p. (CONF-8909489--: 10. National Meeting on Physics of Particles and Fields, Itatiaia (Brazil), 20-24 Sep 1989). In *Proceedings of the 10. National Meeting on Physics of Particles and Fields.* Order Number DE93604123. Source: OSTI; NTIS (US Sales Only); INIS.

We calculate the vertical muons in the atmosphere in hadron showers and compare with experimental data at sea level. (author).

1824 (INIS-BR--2934, pp. 298-301) **Nucleon and pion diffusion in the atmosphere and apparent scaling break.** Portella, H.M. (Centro Brasileiro de Pesquisas Fisicas (CBPF), Rio de Janeiro, RJ (Brazil)); Castro, F.M.O. Sociedade Brasileira de Fisica, Rio de Janeiro, RJ (Brazil). 1989. 350p. (In Portuguese). (CONF-8909489--: 10. National Meeting on Physics of Particles and Fields, Itatiaia (Brazil), 20-24 Sep 1989). In *Proceedings of the 10. National Meeting on Physics of Particles and Fields.* Order Number DE93604123. Source: OSTI; NTIS (US Sales Only); INIS.

The integral flux of hadrons is analytically calculated considering two models for multiple production of pions; the quasi scaling and CKP model. The result is compared with integral flux of hadrons obtained in altitudes of mountains. (M.C.K.).

1825 (INIS-BR--2934, pp. 319-322) **Super families.** Amato, N. (Centro Brasileiro de Pesquisas Fisicas (CBPF), Rio de Janeiro, RJ (Brazil)); Maldonado, R.H.C. Sociedade Brasileira de Fisica, Rio de Janeiro, RJ (Brazil). 1989. 350p. (In Portuguese). (CONF-8909489--: 10. National Meeting on Physics of Particles and Fields, Itatiaia (Brazil), 20-24 Sep 1989). In *Proceedings of the 10. National Meeting on Physics of Particles and Fields.* Order Number DE93604123. Source: OSTI; NTIS (US Sales Only); INIS.

The study on phenomena in the super high energy region, $\Sigma E_i > 1000$ TeV revealed events that present a big dark spot in central region with high concentration of energy and particles, called halo. Six super families with halo were analysed by Brazil-Japan Cooperation of Cosmic Rays. For each family the lateral distribution of energy density was constructed and R_c Σ E ($R < R_c$) was estimated. For studying primary composition, the energy correlation with particles released separately in hadrons and gamma rays was analysed. (M.C.K.).

1826 (INIS-BR--2934, pp. 323-326) **OMEGA project.** Shibuya, E.H. (Universidade Estadual de Campinas, SP (Brazil). Inst. de Fisica). Sociedade Brasileira de Fisica, Rio de Janeiro, RJ (Brazil). 1989. 350p. (In Portuguese). (CONF-8909489--: 10. National Meeting on Physics of Particles and Fields, Itatiaia (Brazil), 20-24 Sep 1989). In *Proceedings of the 10. National Meeting on Physics of Particles and Fields.* Order Number DE93604123. Source: OSTI; NTIS (US Sales Only); INIS.

The OMEGA - Observation of Multiple particle production, Exotic Interactions and Gamma-ray Air Shower-project is presented. The project try to associate photosensitive detectors from experiences of hadronic interactions with electronic detectors used by experiences that investigate extensive atmospheric showers. (M.C.K.).

1827 (INIS-BR--2934, pp. 327-330) **Correlation between transverse momentum and multiplicity of C-jets.** Shibuya, E.H. (Universidade Estadual de Campinas, SP (Brazil). Inst. de Fisica). Sociedade Brasileira de Fisica, Rio de Janeiro, RJ (Brazil). 1989. 350p. (In Portuguese). (CONF-8909489--: 10. National Meeting on Physics of Particles and Fields, Itatiaia (Brazil), 20-24 Sep 1989). In *Proceedings of the 10. National Meeting on Physics of Particles and Fields.* Order Number DE93604123. Source: OSTI; NTIS (US Sales Only); INIS.

Studies on hadronic interactions at high energies done by Brazil-Japan Cooperation of cosmic rays are presented. The chamber of photo emulsions-lead used as detector is described. The correlation between transverse momentum and multiplicity is obtained and compared with results obtained from particle accelerators. (M.C.K.).

1828 (INIS-mf--13358, pp. 12) **Vectorial correlations on fractal path: Applications to random walks and turbulence.** Zeitak, Reuven (Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Chemical Physics and Structural Chemistry). Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Physics. 1992. 169p. (CONF-9204195--: 1992 Israel Physical Society annual meeting, Rehovot (Israel), 15 Apr 1992). In *Israel physical society 1992 annual meeting: Program and abstracts.* Order Number DE93604079. Source: OSTI; NTIS (US Sales Only); INIS.

Abstract only. FLOW MODELS/turbulence; CORRELATIONS; TURBULENCE; FRACTALS

1829 (INIS-mf--13358, pp. 81) **Numerical analysis of nonlinear mode-mode interactions in the Rayleigh-Tayler instability.** Ofer, D. (Israel Atomic Energy Commission, Beersheba (Israel). Nuclear Research Center-Negev); Hecht, J.; Shvarts, D.; Zinamon, Z.; Orszag, S.A. Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Physics. 1992. 169p. (CONF-9204195--: 1992 Israel Physical Society annual meeting, Rehovot (Israel), 15 Apr 1992). In *Israel physical society 1992 annual meeting: Program and abstracts.* Order Number DE93604079. Source: OSTI; NTIS (US Sales Only); INIS.

Abstract only. RAYLEIGH-TAYLOR INSTABILITY/fluid flow; INTERACTION RANGE; NONLINEAR PROBLEMS; THREE-DIMENSIONAL CALCULATIONS; TWO-DIMENSIONAL CALCULATIONS

1830 (IYaF--91-62) **Complex apparatus and results of active experiment Electron-1 with injection of electronic beam in the ionosphere.** Bykovskij, V.F. (and others); Goryachev, S.B.; Doroshkin, A.A. AN SSSR, Novosibirsk (Russian Federation). Inst. Yadernoj Fiziki. 1991. 45p. (In Russian). Order Number DE93605452. Source: OSTI; NTIS (US Sales Only); INIS.

The 'Electron' scientific apparatus complex designed for active experiments with electron beam injection from space vehicles board is described. The complex comprises electron injector with high-frequency modulator, a set of board diagnostic equipment and three ejection diagnostic containers. Results of an experiment on the modulated electron beam interaction (0.5A current and 6.5-8 keV energy) with ionospheric plasma at 90-150 km altitudes are presented. Energy spectra of recurrent electrons and ions arriving at a meteorocket are presented. 20 refs.; 25 figs.; 2 tabs.

1831 (LA-UR--92-2946) **Element diffusion in pulsating variables.** Guzik, J.A. Los Alamos National Lab., NM (United States). [1992]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-9207156--1: International Astronomical Union (IAU) colloquium 139 on new perspectives on stellar pulsation and pulsating variable stars, Victoria (Canada), 7-11 Jul 1992). Order Number DE93000795. Source: OSTI; NTIS; GPO Dep.

Can pulsation studies yield information on the operation of element diffusion in stars? Can diffusion explain unusual properties of pulsating variables? Element diffusion theory and recent research relevant to these questions will be reviewed, with emphasis on the Sun and δ Scuti stars. High-degree solar p-modes that are sensitive to helium ionization support a reduced convection zone helium abundance consistent with that expected from diffusion. Intermediate-degree p-modes can be used to probe the structure of the convection zone base and constrain possible diffusion-produced composition gradients. δ Scuti variables have shallow convection zones and relatively short diffusion timescales. Helium diffusion may explain unusual period ratios, influence period changes, and affect the amplitudes and light curve shapes of δ Scuti stars.

1832 (LBL--31565) **Choice and meaning in the quantum universe.** Stapp, H.P. Lawrence Berkeley Lab., CA (United States). 22 May 1992. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-9112138--1: 21. Congress of science et tradition: perspectives transdiciplinaries, ouvertures vers eme siecle at l'U.N.E.S.C.O., Paris (France), 2-6 Dec 1991). Order Number DE92041186. Source: OSTI; NTIS; INIS; GPO Dep.

This report discusses whether the events that occur in the universe evolve deterministicly or randomly or both. (LSP).

1833 (LBL--32562) **Interpretation of rapidly rotating pulsars.** Weber, F. (Technische Univ. Muenchen, Garching (Germany). Inst. fuer Theoretische Physik); Glendenning, N.K.

Lawrence Berkeley Lab., CA (United States). 5 Aug 1992. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-9207113–3: 2. international symposium on nuclear astrophysics: nuclei in the cosmos, Karlsruhe (Germany), 6-10 Jul 1992). Order Number DE93000576. Source: OSTI; NTIS; INIS; GPO Dep.

The minimum possible rotational period of pulsars, which are interpreted as rotating neutron stars, is determined by applying a representative collection of realistic nuclear equations of state. It is found that none of the selected equations of state allows for neutron star rotation at periods below 0.8–0.9 ms. Thus, this work strongly supports the suggestion that if pulsars with shorter rotational periods were found, these are likely to be strange-quark-matter stars. The conclusion that the confined hadronic phase of nucleons and nuclei is only metastable would then be almost inescapable, and the plausible ground-state in that event is the deconfined phase of (3-flavor) strange-quark-matter.

1834 (LBL–32634) **Measuring q_0 using supernovae at $z \approx 0.3$.** Newberg, H.J.M. Lawrence Berkeley Lab., CA (United States). Jul 1992. 112p. Sponsored by USDOE, Washington, DC (United States); National Science Foundation, Washington, DC (United States). DOE Contract AC03-76SF00098. Contract AST8809616. Order Number DE92041164. Source: OSTI; NTIS; INIS; GPO Dep.

The measurement of q_0 is extremely important for understanding the quantity of matter in our universe. The measurement of q_0 using supernovae of type Ia as standard candles is appealing because it requires less modeling than other methods using galaxies. The challenge with using supernovae to measure q_0 is in finding enough of them. In order to find supernovas, we have constructed a very popular f/1 camera for the 3.9m Anglo-Australian Telescope. The camera uses reducing optics that put a 17 in. x 17 in. field on a 1024 x 1024 pixel Thomson CCD. Using this system, we image to 23rd magnitude in five minutes. We have developed a software package that uses image subtraction to find supernovae that are approximately magnitude 22.4 or brighter in these images. One field can be processed every 6.6 minutes on a relatively unloaded VAX 6000-6510. We estimate that this system should find one supernova in every 105–139 images (about two nights of observation on the AAT). Throughout the two years of operation, we observed the equivalent of about four nights with seeing better than two arc seconds. Although we found many candidates, we were unable to confirm any supernovae. The next generation of this search is currently using the 2.5m Isaac Newton Telescope in the Canary Islands. We have solved many problems encountered with the AAT search by targeting distant clusters of galaxies, by operating at a site that allows higher resolution imaging, and by scheduling follow-up observations. This system, although still in its infancy, has yielded one event that could be a high redshift supernova. We estimate that it will require 36 type Ia supernovae, discovered at or before maximum, to find q_0 to within 0.2, and 144 such supernovae to measure q_0 within 0.1. Clearly, the program will have to be expanded to find this quantity of supernovae.

6620 Physics of Elementary Particles and Fields

Refer also to citation(s) 1988, 2450

1835 (CEA-DAPNIA-RA–1991) **Annual report 1991.** CEA Centre d'Etudes de Saclay, 91 - Gif-sur-Yvette (France). Dept. d'Astrophysique, de la Physique des Particules, de la Physique Nucleaire et de l'Instrumentation Associee. Jun 1992. 362p. (In French). Order Number DE93721020. Source: OSTI; NTIS (US Sales Only); INIS.

DAPNIA, department of Astrophysics, Particle Physics, Nuclear Physics and Associated Instrumentation is a new CEA department, created in July 1991. This report makes the synthesis and gives the prospects of department activities. In Nuclear Physics, 3 topics are studied: nuclear structure with DAPNIA superconducting post-accelerated tandem and GANIL cyclotron, thermodynamics properties with GANIL cyclotron and LNS, and hadronic systems with SPS and SLAC. In Particle Physics, DAPNIA participates in experimental program that has been decided to establish the validity of Standard Model near to electron-positron colliders of LEP. Cryo magnetism and superconducting cavity laboratories contribute to DAPNIA programs and participate in outer programs.

1836 (CEA-DAPNIA-SPP–92-12) **Elementary particles and basic interactions. Trends and perspectives.** Baton, J.P.; Cohen-Tannoudji, G. CEA Centre d'Etudes de Saclay, 91 - Gif-sur-Yvette (France). Dept. d'Astrophysique, de la Physique des Particules, de la Physique Nucleaire et de l'Instrumentation Associee. Jun 1992. 235p. (In French). Order Number DE93720979. Source: OSTI; NTIS (US Sales Only); INIS.

This lesson given to Physics teachers, takes stock of actual knowledge and trends in Particle Physics: basic interactions and unification, elementary particles (lepton-quarks), fields theories, boson and gluon discovery. It reminds the operating principle of different large accelerators established in the world and associated particle detectors. It includes also a glossary.

1837 (DOE/ER/40546–1) **High energy physics research: [Annual report , January 1, 1992–December 31, 1992].** Branson, J. California Univ., San Diego, La Jolla, CA (United States). [1992]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG03-90ER40546. Order Number DE93000305. Source: OSTI; NTIS; INIS; GPO Dep.

This is a progress report on the first year of the five year proposal of the UCSD high energy physics group. The main activity of our group continues to be the L3 experiment at LEP. During the last year in L3, we have worked principally on physics analysis. We have also fulfilled our duties in running the detector and contributing to L3 software and computing. In addition, we have made a major effort toward the development of the GEM detector at the SSC. Our SSC work is done in collaboration with the other UCSD groups which are primarily supported by the NSF. In this progress report, we will review our recent activities and describe the current status of the group. Some of the publications and documents which display the work of our group over the last year are included as appendices. We will also outline our research plan to continue our participation in L3 physics and upgrades and to work on the design and construction of the GEM detector.

1838 (DOE/ER/40661–1) **Indiana University high energy physics, Task A: Technical progress report, April 1991–April 1992.** Brabson, B.; Crittenden, R.; Dzierba, A.; Hanson, G.; Martin, H.; Marshall, T.; Mir, R.; Mouthy, T.; Ogren, H.; Rust, D.; Teige, S.; Zieminska, D.; Zieminski, A. Indiana Univ., Bloomington, IN (United States). Dept. of Physics. [1992]. 110p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-91ER40661. Order Number DE93001430. Source: OSTI; NTIS; INIS; GPO Dep.

During this reporting period the group has been carrying out programs in several areas. These are presented in this paper is follows: The group was a collaborator in the Mark II experiment at the SLC and completed analysis on the experiment. Three students completed their theses this reporting period; the group is the prime mover in (E672), a high mass dimuon experiment which now in its final data collection period. Our group is also a collaborator in the DO collider experiment which is now preparing for the first data run in 1992; the group is a collaborator in the OPAL experiment at LEP which is now taking data. The group also is working on the development of a major offline facility shift and on a silicon vertex chamber for 1993; the group is the prime mover in the construction of a major new experiment (E852) in precision meson spectroscopy. A test run is presently underway and data taking will begin in 1993; and the group is a prime mover in the tracking design of the SDC experiment. The SDC has completed the Technical Design report. Construction will begin in 1993.

1839 (INIS-BR–2934) **Proceedings of the 10. National Meeting on Physics of Particles and Fields.** Sociedade Brasileira de Fisica, Rio de Janeiro, RJ (Brazil). 1989 350p. (In Portuguese). (CONF-8909489–: 10. National Meeting on Physics of Particles and Fields, Itatiaia (Brazil), 20-24 Sep 1989). Order Number DE93604123. Source: OSTI; NTIS (US Sales Only); INIS.

Researches in the areas of Physics of particles and fields, carried out in Brazil, are presented. (M.C.K.).

1840 (LAL-RA–90-91) **Linear Accelerator Laboratory - Progress report 1990-1991.** Paris-11 Univ., 91 - Orsay (France).

Lab. de l'Accelerateur Lineaire. 1991. 98p. (In French). Order Number DE93721001. Source: OSTI; NTIS (US Sales Only); INIS.

During the last two years, physics experiments at LAL have focused towards new lines: end of fixed target experiments, continuity of underground physics, high activity of physics in collisions, opening towards astrophysics. Two experiments have reached their final analysis phase: NA31 for the study of CP violation and rare decays in K neutral's, UA2' for pantip collisions. Since the first e^+e^- collisions in August 1989, LEP experiments, Aleph and Delphi, have produced a huge amount of results on Z neutral physics and searches for new phenomena. After several years of design, construction and installation, the H1 detector is now waiting for the first ep collisions at HERA. Feasibility experiments as NEMO and Themistocle have reached a first step in proving the possibility of observing double beta decays for the former, point sources of cosmic gammas of very high energy for the latter. Two astrophysics experiments are at preliminary or design levels: the Naines Brunes (Brown Dwarfs) searches for compact massive objects contributing to Dark Matter while the very challenging experiment Virgo aims at the first evidence for gravitational waves. Future experiments, in particular at LHC, are being prepared by R and D in detectors.

1841 (SINS–2106/A, pp. 103-111) **Microphysics evolution and methodology: A few remembrances and reflections on F. Joliot's conceptions on nuclear research.** Dionisio, J.S. (Paris-11 Univ., 91 - Orsay (France). Centre de Spectrometrie Nucleaire et de Spectrometrie de Masse). Institute of Atomic Energy, Otwock-Swierk (Poland). Nov 1990. (CONF-900857–: 21. Mikolajki summer school on nuclear physics: nuclear and atomic physics with accelerators of the nineties, Mikolajki (Poland), 26 Aug - 5 sep 1990). In *Nuclear and atomic physics with the accelerators of the nineties: Proceedings of the 21st Mikolajki summer school on nuclear physics, held in Mikolajki, Poland, August 26 - September 5, 1990. Seminars.* 111p. Order Number DE93604421. Source: OSTI; NTIS (US Sales Only); INIS.

A few general features of microscopics evolution and their relationship with microscopics methodology are briefly surveyed. Several pluri-disciplinary and interdisciplinary aspects of microscopics research are also discussed in the present scientific context. The need for an equilibrium between individual tendencies and collective constraints required by team work, already formulated thirty years ago by Frederic Joliot, is particularly stressed in the present conjuncture of Nuclear Research favouring very large team projects and discouraging individual initiatives. The increasing importance of the science of science (due to their multiple social, economical, ecological aspects) and the stronger competition between national and international tendencies of scientific (and technical) cooperation are also discussed. (author).

6621 General Theory of Particles and Fields

Refer also to citation(s) 1794, 1898, 1899, 1929, 1957, 2036

1842 (ANL-HEP-CP–92-53) **Symmetry of wavefunctions in quantum algebras and supersymmetry.** Zachos, C.K. Argonne National Lab., IL (United States). [1992]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9206289–1: 21. differential geometric methods in theoretical physics (DGMTP) conference, Tianjin (China), 5 Jun 1992). Order Number DE92041129. Source: OSTI; NTIS; INIS; GPO Dep.

The statistics-altering operators η present in the limit q = -1 of multiparticle $SU_q(2)$- invariant subspaces parallel the action of such operators which naturally occur in supersymmetric theories. I illustrate this heuristically by comparison to a toy N = 2 superymmetry algebra, and ask whether there is a supersymmetry structure underlying $SU_q(2)$ in that limit. I remark on the relevance of such alternating-symmetry multiplets to the construction of invariant hamiltonians.

1843 (DOE/ER/40153–9) **Research in particle theory: Annual progress report, November 1, 1991–October 10, 1992.** Mansouri, F.; Suranyi, P.; Wijewardhana, L.C.R. Cincinnati Univ., OH (United States). Oct 1992. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-84ER40153. Order Number DE93002868. Source: OSTI; NTIS; INIS; GPO Dep.

Dynamics of 2+1 dimensional gravity is analyzed by coupling matter to Chern Simons Witten action in two ways and obtaining the exact gravity Hamiltonian for each case. 't Hoot's Hamiltonian is obtained as an approximation. The notion of space-time emerges in the very end as a broken phase of the gauge theory. We have studied the patterns of discrete and continuous symmetry breaking in 2+1 dimensional field theories. We formulate our analysis in terms of effective composite scalar field theories. Point-like sources in the Chern-Simons theory of gravity in 2+1 dimensions are described by their Poincare' charges. We have obtained exact solutions of the constraints of Chern-Simons theory with an arbitrary number of isolated point sources in relative motion. We then showed how the space-time metric is constructed. A reorganized perturbation expansion with a propagator of soft infrared behavior has been used to study the critical behavior of the mass gap. The condition of relativistic covariance fixes the form of the soft propagator. Approximants to the correlation critical exponent were obtained in two loop order for the two and three dimensional theories. We proposed a new model of QED exhibiting two phases and a Majorana mass spectrum of single particle states. The model has a new source of coupling constant renormalization which opposes screening and suggests the model may confine. Assuming that the bound states of e^+e^- essentially obey a Majorana spectrum, we obtained a consistent fit of the GSI peaks as well as predicting new peaks and their spin assignments.

1844 (DOE/ER/40561–76) **The SU(3)-Nambu-Jona-Lasinio soliton in the collective quantization formulation.** Blotz, A. (Washington Univ., Seattle, WA (United States). Inst. for Nuclear Theory); Goeke, K.; Diakonov, D.; Petrov, V.; Pobylitsa, P.V.; Park, N.W. Washington Univ., Seattle, WA (United States). Dept. of Physics. 11 Jun 1992. 36p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG06-90ER40561. Order Number DE92040075. Source: OSTI; NTIS; INIS; GPO Dep.

On grounds of a semibosonized Nambu-Jona-Lasinio model, which has $SU(3)_R \otimes SU(3)_L$-symmetry in the chiral limit, mass splittings for spin 1/2 and spin 3/2 baryons are studied in the presence of an explicit chiral symmetry breaking strange quark mass. To this aim these strangeness carrying baryons are understood as SU(3)-rotational excitations of an SU(2)-embedded soliton solution. Therefore, within the framework of collective quantization, the fermion determinant with the strange quark mass is expanded up to the second order in the flavor rotation velocity and up to the first order in this quark mass. Besides the strange and non-strange moments of inertia, which have some counterparts within the Skyrme model, some so-called anomalous moments of inertia are obtained. These call be related to the imaginary part of the effective Euclidian action and contain among others the anomalous baryon current. This is shown in a gradient expansion up to the first non-vanishing order. Together with the Σ-commutator these are the solitonic ingredients of the collective hamiltonian, which is then diagonalized by means of strict perturbation theory in the strange quark mass and by the Yabu-Ando method. Both methods yield very good results for the masses of the spin 1/2 and 3/2 baryons. The former one reproduces some interesting mass formulas of Gell-Mann Okubo and Guadagnini and the latter one is able to describe the mass splittings up to a few MeV.

1845 (DOE/ER/40617–134) **Research in elementary particle physics: Progress report, March 1, 1992–February 28, 1993.** Chan, Lai-Him; Haymaker, R.; Imlay, R.; McNeil, R.; Metcalf, W.; Svoboda, R. Louisiana State Univ., Baton Rouge, LA (United States). [1992]. 115p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-91ER40617. Order Number DE93001858. Source: OSTI; NTIS; INIS; GPO Dep.

We describe theoretical work on effective action expansion on an effective low energy theory of hadrons and lattice gauge theories. The high energy experimental group at Louisiana State University has analyzed data on a neutrino oscillation experiment at LAMPF. The LSND neutrino experiment is preparing to take data in 1993. IMB data has been analyzed. Preparations for a beam test at KEK for IMB are in progress. Dumand is preparing to test one string of the detector early next summer. The ZEUS electron proton colliding beam experiment has started to take data. Early results have been reported.

1846 (DOE/ER/40682–2) **Maximal CP violation via Higgs-boson exchange.** Lavoura, L. Carnegie-Mellon Univ., Pittsburgh, PA (United States). Dept. of Physics. 6 Mar 1992. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-91ER40682. (CMU-HEP–92-07). Order Number DE93002417. Source: OSTI; NTIS; INIS; GPO Dep.

The unitarity of the mixing matrix of the charged Higgs bosons, and the orthogonality of the mixing matrix of the neutral Higgs bosons, are used to derive upper bounds on the values of general CP-violating expressions. The bounds are independent of the total number of Higgs fields in any specific model. They allow is to relax the usual assumption of only one Higgs boson being light. It is natural that the CP violation in the exchange of neutral Higgs bosons between bottom quarks be particularly large.

1847 (DOE/ER/40682–4) **Comment on "Flavor-changing processes and CP violation in the $S_3 \times Z_3$ model".** Lavoura, L. Carnegie-Mellon Univ., Pittsburgh, PA (United States). Dept. of Physics. 28 Apr 1992. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-91ER40682. (CMU-HEP–92-09). Order Number DE93002415. Source: OSTI; NTIS; INIS; GPO Dep.

Deshpande, Gupta and Pal neglected the presence of a complex phase in the mass matrix and in the Yukawa coupling matrices of the down-type quarks I argue that phase should not be neglected, because it can explain the observed CP violation. The mechanism of CP violation considered by those authors may certainly be present, but for simplicity one may want to eliminate it, by restricting the soft-breaking sector of the Higgs potential in such a way that complex Higgs bosons propagators do not occur.

1848 (DOE/ER/40682–11) **Generalized semilocal theories and higher Hopf maps.** Hindmarsh, M. (California Univ., Santa Barbara, CA (United States). Inst. for Theoretical Physics); Holman, R. Carnegie-Mellon Univ., Pittsburgh, PA (United States). Dept. of Physics. Jun 1992. 15p. Sponsored by USDOE, Washington, DC (United States); National Science Foundation, Washington, DC (United States). DOE Contract FG02-91ER40682 ;FG05-85ER40226. Grant PHY89-04035. (NSF-ITP–92-93;CMU-HEP–92-16). Order Number DE93002644. Source: OSTI; NTIS; INIS; GPO Dep.

In semilocal theories, the vacuum manifold is fibered in a non-trivial way by the action of the gauge group. Here we generalize the original semilocal theory (which was based on the Hopf bundle $S^3 \rightarrow^{S1} S^2$) to realize the next Hopf bundle $S^7 \rightarrow^{S3} S^1$, and its extensions $S^{2n+1} \text{yields} S^3$ HP^n. The semilocal defects in this class of theories are classified by $\pi_3(S^3)$, and are interpreted as constrained instantons or generalized sphaleron configurations. We fail to find a field theoretic realization of the final Hopf bundle $S^{15} \rightarrow^{S7} S^8$, but are able to construct other semilocal spaces realizing Stiefel bundles over Grassmanian spaces.

1849 (DOE/ER/40682–12) **Superweak-like models of CP violation.** Lavoura, L. Carnegie-Mellon Univ., Pittsburgh, PA (United States). Dept. of Physics. 19 Jun 1992. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-91ER40682. (CMU-HEP–92-17). Order Number DE93002645. Source: OSTI; NTIS; INIS; GPO Dep.

I put forward a two-Higgs-doublet model in which CP violation is mediated only by the neutral Higgs bosons, via the mechanism of scalar-pseudoscalar mixing. In this model there is no CP violation in the exchange of either W bosons or of charged Higgs bosons. The model is therefore an approximate realization of the superweak theory of CP violation. It has only two basic CP-violating quantities. I point out that other models of this kind, but with more than two Higgs doublets, may also be built.

1850 (IC–92/108) **Spherically symmetric line element and Killing vectors in five-dimensional space.** Rcheulishvili, G. International Centre for Theoretical Physics, Trieste (Italy). Jun 1992. 9p. Order Number DE93604132. Source: OSTI; NTIS (US Sales Only); INIS.

The series of Killing vectors for the line element are described. Their algebras and curvature are presented. The explicit expressions of metrics for higher symmetries are written down. (author). 7 refs.

1851 (IC–92/117) **Lie bialgebras with triangular decomposition.** Andruskiewitsch, N. (Max-Planck-Inst. fuer Mathematik, Bonn (Germany)); Levstein, F. International Centre for Theoretical Physics, Trieste (Italy). Jun 1992. 20p. Order Number DE93604232. Source: OSTI; NTIS (US Sales Only); INIS.

Lie bialgebras originated in a triangular decomposition of the underlying Lie algebra are discussed. The explicit formulas for the quantization of the Heisenberg Lie algebra and some motion Lie algebras are given, as well as the algebra of rational functions on the quantum Heisenberg group and the formula for the universal R-matrix. (author). 17 refs.

1852 (IC–92/146) **Superconformal structures and holomorphic 1/2-superdifferentials on N=1 super Riemann surfaces.** Kachkachi, H.; Kachkachi, M. International Centre for Theoretical Physics, Trieste (Italy). Jul 1992. 15p. Order Number DE93604133. Source: OSTI; NTIS (US Sales Only); INIS.

Using the Super Riemann-Roch theorem we give a local expression for a holomorphic 1/2-superdifferential in a superconformal structure parametrized by special isothermal coordinates on an N=1 Super Riemann Surface (SRS). This construction is done by choosing a suitable origin for these coordinates. The holomorphy of the latter with respect to super Beltrami differentials is proven. (author). 26 refs.

1853 (IC–92/154) **Normal forms of invariant vector fields under a finite group action.** Sanchez Bringas, F. International Centre for Theoretical Physics, Trieste (Italy). Jul 1992. 8p. Order Number DE93604134. Source: OSTI; NTIS (US Sales Only); INIS.

Let Γ be a finite subgroup of GL(n,C). This subgroup acts on the space of germs of holomorphic vector fields vanishing at the origin in C^n. We prove a theorem of invariant conjugation to a normal form and linearization for the subspace of invariant elements and we give a description of these normal forms in dimension n=2. (author).

1854 (IC–92/171) **Electric magnetic duality in string theory.** Sen, A. International Centre for Theoretical Physics, Trieste (Italy). Jul 1992. 16p. (TIFR-TH–92-41.). Order Number DE93606061. Source: OSTI; NTIS (US Sales Only); INIS.

The electric-magnetic duality transformation in four dimensional heterotic string theory discussed by Shapere, Trivedi and Wilczek is shown to be an exact symmetry of the equations of motion of low energy effective field theory even after including the scalar and the vector fields, arising due to compactification, in the effective field theory. Using this duality transformation we construct rotating black hole solutions in the effective field theory carrying both electric and magnetic charges. The spectrum of extremal magnetically charged black holes turn out to be similar to that of electrically charged elementary string excitations lying on the leading Regge trajectory. We also discuss the possibility that the duality symmetry is an exact symmetry of the full string theory under which electrically charged elementary string excitations get exchanged with magnetically charged soliton like solutions. This proposal might be made concrete following the suggestion of Dabholkar et. al. that fundamental strings may be regarded as soliton like classical solutions in the effective field theory. (author). 20 refs.

1855 (IC–92/173) **Redundancy of the quantum level gauge fixing condition.** Kachkachi, H.; Kachkachi, M. International Centre for Theoretical Physics, Trieste (Italy). Jul 1992. 7p. Order Number DE93604135. Source: OSTI; NTIS (US Sales Only); INIS.

We regard the manifold Γ-circumflex defined by the equations of motion (EM) of the gauge and ghost fields w.r.t. the gauge-fixed action as a fiber bundle over the manifold Γ defined by the EM of the gauge fields only w.r.t. the classical action. Accordingly, the BRST operator is interpreted as the nilpotent exterior derivative on Γ; the ghost field appears as the differential 1-form. This fiber bundle setup allows us to prove that any gauge condition on Γ-circumflex is equivalent to another one on the base manifold Γ and does not break the BRST symmetry of the quantized theory. (author). 11 refs.

1856 (IC–92/179) **Solitons and bubbles in models with Chern-Simons term.** Masperi, L. International Centre for Theoretical Physics, Trieste (Italy). Jul 1992. 11p. Order Number DE93606062. Source: OSTI; NTIS (US Sales Only); INIS.

It is shown that a gauge theory for complex scalar field with up to sextic self-interactions and a Chern-Simons term in 2 + 1 dimensions has solitons which may become bubbles of the stable broken-symmetry phase in a medium of the symmetric one producing the first-order phase transition. In the non-relativistic limit scale invariance prevents the determination of an optimal bubble size. Possible extensions to 3 + 1 dimensions of bubbles of string type are indicated. (author). 8 refs.

1857 (IC–92/180) **Superfield wave function for N=4, d=4 superparticle.** Ilieva, N. (International Centre for Theoretical Physics, Trieste (Italy)); Litov, L. International Centre for Theoretical Physics, Trieste (Italy). Jul 1992. 10p. Order Number DE93604136. Source: OSTI; NTIS (US Sales Only); INIS.

A canonical generalized-supertwistor formulation of the superparticle action is given, which provides a natural construction of the quantum superparticle wave function in unconstrained superfield terms. The superspace is considered as a space of parameters of the supercoherent states defining the basis for oscillator-like UIR's of the superconformal group SU(2,2/N) the basis being fixed uniquely by satisfying the spin-shell constraint. A possible superstring action is proposed in analogy with the superparticle one. (author). 12 refs.

1858 (IC–92/184) **The ground state wavefunctions of a conformally invariant scalar field in different spacetime background.** Anini, Y. International Centre for Theoretical Physics, Trieste (Italy). Jul 1992. 17p. Order Number DE93606063. Source: OSTI; NTIS (US Sales Only); INIS.

In this paper we carefully construct the ground state wavefunction of a conformally invariant scalar field as an Euclidean path integral over real field configurations that vanish at the past end point of Euclidean time. We consider two Euclidean spacetime backgrounds. The compact without boundary, i.e., a 4-sphere, and the asymptotically flat, i.e., a wormhole spacetime. Finally, we show that the analytic continuation of these states to the corresponding Lorentzian spacetime satisfy the time-dependent Schroedinger equation with proper choice of the pre-factor for the wavefunction. (author). 5 refs, 2 figs.

1859 (IC–92/187) **Positive energy representations of the conformal quantum algebra.** Dabrowski, L. (International School of Advanced Studies, Trieste (Italy)); Dobrev, V.K.; Husain, V.; Floreanini, R. International Centre for Theoretical Physics, Trieste (Italy). Jul 1992. 13p. (SISSA–137/92/FM;UTS-DFT–22-92.). Order Number DE93606064. Source: OSTI; NTIS (US Sales Only); INIS.

The positive-energy unitary irreducible representations of the q-deformed conformal algebra $\delta C_q = U_q(su(2,2))$ are obtained by appropriate deformation of the classical ones. When the deformation parameter q is N -th root of unity, all these unitary representations become finite-dimensional. For his case we discuss in some detail the massless representations, which are also irreducible representations of the q-deformed Poincare subalgebra of δC_q. Generically, their dimensions are smaller than the corresponding finite-dimensional non-unitary representation of su(2,2), except when N = 2 modul h + 1, where h is the helicity of the representations. The latter cases include the fundamental representations with $h = \pm 1/2$. (author). 10 refs.

1860 (IC–92/190) **Connections between quantized affine algebras and superalgebras.** Zhang, R.B. International Centre for Theoretical Physics, Trieste (Italy). Aug 1992. 12p. Order Number DE93606065. Source: OSTI; NTIS (US Sales Only); INIS.

Every affine superalgebra with a symmetrizable Cartan matrix is closely related to an ordinary affine algebra with the same Cartan matrix. It is shown that the quantum supergroup associated with the former is essentially isomorphic to the quantum group associated with the latter in an appropriate class of representations. At the classical level, each integrable irreducible highest weight representation of the affine superalgebra has a corresponding irreducible representation of the affine algebra, which has the same weight space decomposition. (author). 5 refs, 3 tabs.

1861 (IC–92/195) **On a permutation character of the group $GL_n(q)$.** Darafsheh, M.R. International Centre for Theoretical Physics, Trieste (Italy). Jul 1992. 5p. Order Number DE93606066. Source: OSTI; NTIS (US Sales Only); INIS.

A theorem concerning the permutation character of the linear group $GL_n(q)$ on $Vn(q)^*$ where Vn(q) is a vector space is demonstrated. 3 refs.

1862 (INIS-BR–2934, pp. 16-30) **Quantum gravity.** Lyra, J.G. de (Sao Paulo Univ., SP (Brazil). Inst. de Fisica). Sociedade Brasileira de Fisica, Rio de Janeiro, RJ (Brazil). 1989. 350p. (In Portuguese). (CONF-8909489–: 10. National Meeting on Physics of Particles and Fields, Itatiaia (Brazil), 20-24 Sep 1989). In *Proceedings of the 10. National Meeting on Physics of Particles and Fields.* Order Number DE93604123. Source: OSTI; NTIS (US Sales Only); INIS.

The gravity quantization is discussed; and an explanation on quantum field theory is presented. (M.C.K.).

1863 (INIS-BR–2934, pp. 31-72) **Conformal field theories and representation of Virasoro and Kac-Moody algebra.** Ferreira, L.A. (Instituto de Fisica Teorica (IFT), Sao Paulo, SP (Brazil)). Sociedade Brasileira de Fisica, Rio de Janeiro, RJ (Brazil). 1989. 350p. (In Portuguese). (CONF-8909489–: 10. National Meeting on Physics of Particles and Fields, Itatiaia (Brazil), 20-24 Sep 1989). In *Proceedings of the 10. National Meeting on Physics of Particles and Fields.* Order Number DE93604123. Source: OSTI; NTIS (US Sales Only); INIS.

An introduction to study Virasoro and Kac-Moody algebra in quantum field theory with two-dimension conformal invariance using free fermions as example is presented. (M.C.K.).

1864 (INIS-BR–2934, pp. 91-115) **Fractionary statistics and field theories in (2+1) dimensions.** Gomes, M. (Sao Paulo Univ., SP (Brazil). Inst. de Fisica). Sociedade Brasileira de Fisica, Rio de Janeiro, RJ (Brazil). 1989. 350p. (In Portuguese). (CONF-8909489–: 10. National Meeting on Physics of Particles and Fields, Itatiaia (Brazil), 20-24 Sep 1989). In *Proceedings of the 10. National Meeting on Physics of Particles and Fields.* Order Number DE93604123. Source: OSTI; NTIS (US Sales Only); INIS.

The existence of fractionary angular momentum and the exotic statistics in many dimensions are analysed. The soliton type excitations of non linear sigma model with 0(3) symmetry are considered. The parity breaking through mass term and the generation of Chern Simon term are discussed in three dimensional fermion model. It is shown that the symmetry breaking can be due to vacuum and this possibility is illustrated in the context of Gross-Never similar model. (M.C.K.).

1865 (INIS-BR–2934, pp. 116-124) **Gauss-Bonnet actions and their dimensionally reduced descendants.** Mueller-Hoissen, F. (Goettingen Univ. (Germany). Inst. fuer Theoretische Physik). Sociedade Brasileira de Fisica, Rio de Janeiro, RJ (Brazil). 1989. 350p. (CONF-8909489–: 10. National Meeting on Physics of Particles and Fields, Itatiaia (Brazil), 20-24 Sep 1989). In *Proceedings of the 10. National Meeting on Physics of Particles and Fields.* Order Number DE93604123. Source: OSTI; NTIS (US Sales Only); INIS.

A brief introduction to Gauss-Bonnet type generalizations of the Einstein-Hilbert gravity action in more than four dimensions is given and the structure of associated (effective) theories obtained by dimensional reduction is discussed. (author).

1866 (INIS-BR–2934, pp. 235-239) **Soliton bubbles and phase transformations.** Masperi, L. (Comision Nacional de Energia Atomica, San Carlos de Bariloche (Argentina). Centro Atomico Bariloche). Sociedade Brasileira de Fisica, Rio de Janeiro, RJ (Brazil). 1989. 350p. (In Spanish). (CONF-8909489–: 10. National Meeting on Physics of Particles and Fields, Itatiaia (Brazil), 20-24 Sep 1989). In *Proceedings of the 10. National Meeting on Physics of Particles and Fields.* Order Number DE93604123. Source: OSTI; NTIS (US Sales Only); INIS.

It is shown that no topological classical solutions in form of bubbles of a real scalar field theory with Lagrangian of quartet and sextet self interactions in 1+1 dimensions are responsible to discontinue transitions in the quantum problem between phases with degenerated and disordered excited level. (M.C.K.).

1867 (INIS-BR–2934, pp. 271-274) **Consistences for introducing more vector potentials in the same group, by BRST algorithm.** Doria, R. (Universidade Catolica de Petropolis, RJ (Brazil)); Carvalho, F.A.R. de. Sociedade Brasileira de Fisica, Rio de Janeiro, RJ (Brazil). 1989. 350p. (In Portuguese). (CONF-8909489–: 10. National Meeting on Physics of Particles and Fields, Itatiaia (Brazil), 20-24 Sep 1989). In *Proceedings of the 10. National Meeting on Physics of Particles and Fields.* Order Number DE93604123. Source: OSTI; NTIS (US Sales Only); INIS.

The BRS formalism for quantum formulation of gauge theory is analysed applying to extended models. The quantum effective Lagrangian of gauge is established, invariant under s and s→ for a system with vector potentials belong to one Abelian group of gauge. The BRS charge associated to the system is calculated. (M.C.K.).

1868 (INIS-BR–2934, pp. 280-285) **Parity-violating anomaly in three-dimensional supergravity.** Mello, E.R.B. de (Paraiba Univ., Joao Pessoa, PB (Brazil). Dept. de Fisica). Sociedade Brasileira de Fisica, Rio de Janeiro, RJ (Brazil). 1989. 350p. (CONF-8909489–: 10. National Meeting on Physics of Particles and Fields, Itatiaia (Brazil), 20-24 Sep 1989). In *Proceedings of the 10. National Meeting on Physics of Particles and Fields.* Order Number DE93604123. Source: OSTI; NTIS (US Sales Only); INIS.

The parity-violating part of the one-loop order correction of the locally supersymmetric effective action for a massless scalar superfield coupled to a background (not quantised) superdreibein in three dimensions is presented. The lowest-order approximation to the gravitational Chern-Simons term and its fermionic equivalent term are obtained. (author).

1869 (INIS-BR–2934, pp. 286-289) **The Gauss-Bonnet identity in quartic gravitation theories.** Gomes, M. (Sao Paulo Univ., SP (Brazil). Inst. de Fisica). Sociedade Brasileira de Fisica, Rio de Janeiro, RJ (Brazil). 1989. 350p. (In Portuguese). (CONF-8909489–: 10. National Meeting on Physics of Particles and Fields, Itatiaia (Brazil), 20-24 Sep 1989). In *Proceedings of the 10. National Meeting on Physics of Particles and Fields.* Order Number DE93604123. Source: OSTI; NTIS (US Sales Only); INIS.

The possible modifications in Gauss-Bonnet relation due to quantum oscillations are studied. The introduction of quantum operator correspondent in the function of two points, in space without singularities is calculated. (M.C.K.).

1870 (INIS-BR–2934, pp. 240-243) **Chiral symmetry breaking in QED_3.** Almeida, L.D. (Instituto de Fisica Teorica (IFT), Sao Paulo, SP (Brazil)); Natale, A.A. Sociedade Brasileira de Fisica, Rio de Janeiro, RJ (Brazil). 1989. 350p. (In Portuguese). (CONF-8909489–: 10. National Meeting on Physics of Particles and Fields, Itatiaia (Brazil), 20-24 Sep 1989). In *Proceedings of the 10. National Meeting on Physics of Particles and Fields.* Order Number DE93604123. Source: OSTI; NTIS (US Sales Only); INIS.

The dynamical chiral symmetry breaking in QED_3 with N fermions is studied. The Schwinger-Dyson equation of fermionic propagator has a bifurcation in $N=32/\Pi^2$. The calculation of effective potential for composed operators confirms this result. (M.C.K.).

1871 (INIS-BR–2934, pp. 253-256) **Construction of Green functions on generalized coherent states.** Boschi Filho, H. (UNESP, Guaratingueta, SP (Brazil). Dept. de Fisico-Quimica); Vaidya, A.N. Sociedade Brasileira de Fisica, Rio de Janeiro, RJ (Brazil). 1989. 350p. (In Portuguese). (CONF-8909489–: 10. National Meeting on Physics of Particles and Fields, Itatiaia (Brazil), 20-24 Sep 1989). In *Proceedings of the 10. National Meeting on Physics of Particles and Fields.* Order Number DE93604123. Source: OSTI; NTIS (US Sales Only); INIS.

Green functions for arbitrary system with su(1,1) symmetry are constructed from generalized coherent states. The case of double-ring shaped oscillator is solved. (M.C.K.).

1872 (INIS-BR–2934, pp. 257-260) **SL(2,R) current algebra in two-dimensional conformal quantum gravity.** Abdalla, E. (Sao Paulo Univ., SP (Brazil). Inst. de Fisica); Abdalla, M.C.B.; Zadra, A. Sociedade Brasileira de Fisica, Rio de Janeiro, RJ (Brazil). 1989. 350p. (In Portuguese). (CONF-8909489–: 10. National Meeting on Physics of Particles and Fields, Itatiaia (Brazil), 20-24 Sep 1989). In *Proceedings of the 10. National Meeting on Physics of Particles and Fields.* Order Number DE93604123. Source: OSTI; NTIS (US Sales Only); INIS.

The SL(2,R) current algebra in two-dimensional conformal quantum gravity is obtained from its residual symmetries, in the gauge of light cone. (M.C.K.).

1873 (INIS-BR–2934, pp. 261-265) **Jordan algebra and the construction of Kac-Moody algebra.** Ferreira, L.A. (Instituto de Fisica Teorica (IFT), Sao Paulo, SP (Brazil)); Gomes, J.F.; Teotonio Sobrinho, P.; Zimerman, A.H. Sociedade Brasileira de Fisica, Rio de Janeiro, RJ (Brazil). 1989. 350p. (In Portuguese). (CONF-8909489–: 10. National Meeting on Physics of Particles and Fields, Itatiaia (Brazil), 20-24 Sep 1989). In *Proceedings of the 10. National Meeting on Physics of Particles and Fields.* Order Number DE93604123. Source: OSTI; NTIS (US Sales Only); INIS.

It is shown that Jordan algebra presents fundamental structure from which Lie algebra and Kac-Moody algebra can be constructed. (M.C.K.).

1874 (INIS-BR–2934, pp. 266-270) **Supersymmetry and new analytical (exact) solutions of Schroedinger equation.** Drigo Filho, E. (Instituto de Fisica Teorica (IFT), Sao Paulo, SP (Brazil)); Ricotta, R.M. Sociedade Brasileira de Fisica, Rio de Janeiro, RJ (Brazil). 1989. 350p. (In Portuguese). (CONF-8909489–: 10. National Meeting on Physics of Particles and Fields, Itatiaia (Brazil), 20-24 Sep 1989). In *Proceedings of the 10. National Meeting on Physics of Particles and Fields.* Order Number DE93604123. Source: OSTI; NTIS (US Sales Only); INIS.

The algebraic aspects of supersymmetric quantum mechanics are applied to calculate some spectral states of a Hamiltonian. (M.C.K.).

1875 (INIS-BR–2934, pp. 275-279) **The most general solutions of Einstein equations.** Souza, M.M. de (Espirito Santo Univ., Vitoria, ES (Brazil). Dept. de Fisica e Quimica). Sociedade Brasileira de Fisica, Rio de Janeiro, RJ (Brazil). 1989. 350p. (In Portuguese). (CONF-8909489–: 10. National Meeting on Physics of Particles and Fields, Itatiaia (Brazil), 20-24 Sep 1989). In *Proceedings of the 10. National Meeting on Physics of Particles and Fields.* Order Number DE93604123. Source: OSTI; NTIS (US Sales Only); INIS.

It is shown that the most general diagonal solutions of Einstein equations are conformally plane using concepts and techniques of simultaneous substitutional symmetries. (M.C.K.).

1876 (INIS-BR–2934, pp. 290-293) **Spontaneous symmetry breaking in O(N)xO(N) model.** Mendes, R.S. (Sao Paulo Univ., SP (Brazil). Inst. de Fisica); Ribeiro, R.F.; Gomes, M.; Silva, A.J. da. Sociedade Brasileira de Fisica, Rio de Janeiro, RJ (Brazil). 1989. 350p. (In Portuguese). (CONF-8909489–: 10. National Meeting on Physics of Particles and Fields, Itatiaia (Brazil), 20-24 Sep 1989). In *Proceedings of the 10. National Meeting on Physics of Particles and Fields.* Order Number DE93604123. Source: OSTI; NTIS (US Sales Only); INIS.

The analysis of effective potential of O(N)xO(N) model, in dominant order of 1/N expansion, at zero and finite temperature is presented. (M.C.K.).

1877 (INIS-BR–2934, pp. 313-318) **Rational functions in Skyrme model.** Ferreira, E. (Pontificia Univ. Catolica do Rio de Janeiro, RJ (Brazil). Dept. de Fisica); Galain, R.M.; Ananias Neto, J. Sociedade Brasileira de Fisica, Rio de Janeiro, RJ (Brazil). 1989. 350p. (In Portuguese). (CONF-8909489–: 10. National Meeting on Physics of Particles and Fields, Itatiaia (Brazil), 20-24 Sep 1989). In *Proceedings of the 10. National Meeting on Physics of Particles and Fields.* Order Number DE93604123. Source: OSTI; NTIS (US Sales Only); INIS.

The Rational functions which represent the exact solution for cosine of the hedgehog form chiral angle of Skyrme soliton are constructed. (M.C.K.).

1878 (INIS-mf–13358, pp. 48) **Normal ordering for deformed boson operators.** Katriel, Jacob (Technion-Israel Inst. of Tech., Haifa (Israel). Dept. of Chemistry); Kibler, Maurice. Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Physics. 1992. 169p. (CONF-9204195–: 1992 Israel Physical Society annual meeting, Rehovot (Israel), 15 Apr 1992). In *Israel physical society*

1992 annual meeting: Program and abstracts. Order Number DE93604079. Source: OSTI; NTIS (US Sales Only); INIS.
Abstract only. BOSON EXPANSION/bosons; BOSONS

1879 (INIS-mf-13358, pp. 60) **Slave bosons treatment of the degenerate Anderson impurity with finite on-site Coulomb interaction.** Schiller, A. (Hebrew Univ., Jerusalem (Israel). Racah Inst. of Physics); Zevin, V. Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Physics. 1992. 169p. (CONF-9204195--: 1992 Israel Physical Society annual meeting, Rehovot (Israel), 15 Apr 1992). In *Israel physical society 1992 annual meeting: Program and abstracts.* Order Number DE93604079. Source: OSTI; NTIS (US Sales Only); INIS.
Abstract only. ANDERSONITE/boson expansion; ANDERSONITE

1880 (INIS-mf-13358, pp. 63) **Fermi correlations in the Landau-Zener dynamics.** Weinstein, Aharon (Weizmann Inst. of Science, Rehovoth (Israel)); Gefen, Yuval; Shimshoni, Efrat; Ben-Jacob, Eshel. Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Physics. 1992. 169p. (CONF-9204195--: 1992 Israel Physical Society annual meeting, Rehovot (Israel), 15 Apr 1992). In *Israel physical society 1992 annual meeting: Program and abstracts.* Order Number DE93604079. Source: OSTI; NTIS (US Sales Only); INIS.
Abstract only. LANDAU-ZENER FORMULA/fermi statistics

1881 (INIS-mf-13358, pp. 69) **Deriving the Standard-Model from the superstring.** Faraggi, Alon E. (Weizmann Inst. of Science, Rehovoth (Israel)). Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Physics. 1992. 169p. (CONF-9204195--: 1992 Israel Physical Society annual meeting, Rehovot (Israel), 15 Apr 1992). In *Israel physical society 1992 annual meeting: Program and abstracts.* Order Number DE93604079. Source: OSTI; NTIS (US Sales Only); INIS.
Abstract only. STRING MODELS/standard model; SYMMETRY GROUPS

1882 (IYaF-90-119) **Symmetries of generating problems and integrable equations.** Konopel'chenko, B.G. AN SSSR, Novosibirsk (Russian Federation). Inst. Yadernoj Fiziki. 1991. 10p. Order Number DE93606081. Source: OSTI; NTIS (US Sales Only); INIS.
It is shown that infinite-dimensional Abelian symmetries of generating equations lead to the occurrence of non-linear equations for wave functions and potentials integrated by means of inverse spectral transformation. 13 refs.

1883 (IYaF-91-31) **On the photonic chiral anomaly in an external gravitational field.** Dolgov, A.D.; Kostyuk, S.V.; Khriplovich, I.B. AN SSSR, Novosibirsk (Russian Federation). Inst. Yadernoj Fiziki. 1991. 12p. Order Number DE93606082. Source: OSTI; NTIS (US Sales Only); INIS.
The anomaly of the photonic chiral current in an external gravitational field parallel by means of the ultraviolet and infrared regularization for spins 1/2 and 1 is discussed. 15 refs.

1884 (JINR-E-2-91-7) **Geometrical approach to the dynamics of a relativistic string in the D-dimensional Minkowski space.** Barbashov, B.M. (Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Theoretical Physics); Shvetz, N.R. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Theoretical Physics. 1991. 15p. Order Number DE93606071. Source: OSTI; NTIS (US Sales Only); INIS.
A geometrical method is considered of solving the boundary-value problem in the theory of a relativistic string with point masses at the ends in the D-dimensional pseudo-Euclidean space. The string world surface restricted by two curves, the world trajectories of the point masses, is described in terms of the quadratic differential forms and the torsion vectors. The case D=4 is considered in detail where the equations of the boundaries of the string surface become the Frenet equations. The choice of the constant second and third curvatures of the world trajectories, the latter being equal to zero, determines the world sheet of a relativistic string to be a helicoid, when appropriate transformations of global coordinates are made. The same result has been obtained in a space with D>4, but this requires a further estimate of the torsion vectors at the boundaries. 10 refs.

1885 (JINR-E-2-91-11) **Status of CP violation in K decays within chiral perturbation theory.** Bel'kov, A.A. (Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Theoretical Physics); Ebert, D.; Lanev, A.V. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Theoretical Physics. 1991. 18p. Order Number DE93606083. Source: OSTI; NTIS (US Sales Only); INIS.
In the framework of recently derived effective strong and weak meson Lagrangians an analysis of $K \to 2\pi$, $K \to 3\pi$ and $K \to 2\pi\gamma$ decay amplitudes is performed and the current status of direct CP violation in nonleptonic K decays is reviewed. Besides estimates of the charge CP-asymmetry for decay probabilities and slope parameters in charged $K^{\pm} \to 3\pi$ decays, a discussion of the Li-Wolfenstein relation for the direct CP-violation parameter in neutral $K^0(K\text{-bar}^0) \to 3\pi$ decays is given. 30 refs.; 6 figs.

1886 (JINR-E-2-91-316) **Beyond two dimensions.** Tapia, V. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Theoretical Physics. 1991. 7p. Order Number DE93606084. Source: OSTI; NTIS (US Sales Only); INIS.
It is shown that the critical dimension, for which the symmetry group of a conformal field theory is infinite-dimensional, is equal to the rank of the metric of the base space. It is proved our claim for fourth-rank metrics and show that the critical dimension is four. The symmetry group is Vir+Vir+Vir+Vir. 8 refs.

1887 (JINR-E-2-91-326) **Superfield actions for N=4 WZNW-Liouville systems.** Gorovoj, O.E.; Ivanov, E.A. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Theoretical Physics. 1991. 18p. Order Number DE93606085. Source: OSTI; NTIS (US Sales Only); INIS.
A manifestly supersymmetric formulation of two-dimensional SU(2)xU(1) and SO(4)xU(1)xU(1) N=4 superconformal WZNW sigma models as well as their Liouville extensions via unconstrained N=4 superfluid prepotentials is obtained. Off-shell actions for these systems, both in N=4 2D superspace and ordinary space, and study the invariance properties of the actions under SO(4)xU(1) and SU(2) N=4 superconformal symmetries are constructed. 18 refs.

1888 (JINR-E-2-91-328) **Nonlinear realizations of W_3 symmetry.** Ivanov, E.A. (Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Theoretical Physics); Krivonos, S.O.; Pichugin, A.A. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Theoretical Physics. 1991. 15p. Order Number DE93606086. Source: OSTI; NTIS (US Sales Only); INIS.
Submitted to Phys. Lett., B.
We derive the Toda lattice realization of classical W_3 symmetry on two scalar fields in a purely geometric way, proceeding from a nonlinear realization of some associate higher-spin symmetry W_3^{∞} is derived. The Toda lattice equations are interpreted as the constraints singling out a two-dimensional fully geodesic subspace in the initial coset space of W_3^{∞}. This subspace is the quotient of SL(3,R) over its maximal parabolic subgroup. 20 refs.

1889 (JINR-E-2-91-437) **Character of phase transition in two- and three-dimensional scalar $g\phi^4$ theory.** Efimov, G.V.; Ganbold, G. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Theoretical Physics. 1991. 11p. Order Number DE93606068. Source: OSTI; NTIS (US Sales Only); INIS.
Phase structure of the scalar ϕ^4 theory is considered in two and three dimensions within the method of Effective Potential. This result indicates the absence of second-order phase transitions in these models. 13 refs.

1890 (JINR-E-2-91-445) **Phase structure of three- and four-dimensional ϕ^4 field theory.** Efimov, G.V. (Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Theoretical Physics); Nedel'ko, S.N. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Theoretical Physics. 1991. 28p. Order Number DE93606069. Source: OSTI; NTIS (US Sales Only); INIS.
Strong coupling regime of $g\phi$ theory in space-time R^d for d=3,4 is investigated by the methods of canonical transformations and

renormalization group. Comparison with the case d=2 shows a crucial influence of the renormalization structure of the theory of its phase structure. 19 refs.; 7 figs.; 1 tab.

1891 (JINR-E-2-91-448) **A covariant form of the Maxwell's equations in four-dimensional spaces with an arbitrary signature.** Lukac, I. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Theoretical Physics. 1991. 22p. Order Number DE93606070. Source: OSTI; NTIS (US Sales Only); INIS.

The concept of duality in the four-dimensional spaces with the arbitrary constant metric is strictly mathematically formulated. A covariant model for covariant and contravariant bivectors in this space based on three four-dimensional vectors is proposed. 14 refs.

1892 (JINR-E-2-91-449) **Application of the unitary representations of the Lorentz group for the description of interaction of a fermion with a scalar particle.** Frik, R.A.; Skachkov, N.B. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Theoretical Physics. 1991. 16p. Order Number DE93606087. Source: OSTI; NTIS (US Sales Only); INIS.

Unitary irreducible representations (UIR) of the Lorentz group applied to transform the relativistic three dimensional equations in the momentum space, that describe the interaction of the fermion and the pseudoscalar particle, to the relativistic configurational representation. By help of the addition theorem for the functions, that realize the UIR of the Lorentz group with the nonzero spin, the local potentials in this representation is found. 14 refs.

1893 (JINR-E-5-90-578) **Operator ordering and symbol representations of enveloping algebras.** Lassner, W. (Leipzig Univ. (Germany)). Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Computing Techniques and Automation. 1990. 10p. Order Number DE93606088. Source: OSTI; NTIS (US Sales Only); INIS.

Phase space methods in quantum theory make use of symbol representations of the Weyl algebra. The method can be generalized to enveloping algebras U(L) of Lie algebras L different from the Heisenberg Lie algebra. The method starts from a one-to-one correspondence between the linear space of the enveloping algebra U(L) and that of the symmetric algebra S(L) over L. The algebra S(L) can be equipped with a so-called twisted product so that it becomes isomorphic to U(L). Different ordering rules correspond to different bases in U(L). The elements of U(L) are represented by different symbols in dependence on the ordering rule chosen. We generalize the notion of an ordering defining function ϕ. This helps to determine a transformation between different types of symbols and allows to use the same fast multiplication algorithm for different orderings. 14 refs.

1894 (JINR-E-5-91-402) **Computer algebra tools for higher symmetry analysis of nonlinear evolution equations.** Gerdt, V.P. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Computing Techniques and Automation. 1991. 10p. Order Number DE93606089. Source: OSTI; NTIS (US Sales Only); INIS.

Submitted to Working conference on Programming environments for high-level scientific problem solving, 23-27 September, 1991, Karlsruhe, Germany.

Paper presents a computer-aided approach and a software package for symbolic algebraic computation to solve the problem of verifying the existence of the canonical Lie-Backlund symmetries for multicomponent quasilinear evolution equations with polynomial-nonlinearity and computing a given order symmetry. In the presence of arbitrary numerical parameters the problem is reduced to investigation and solving of nonlinear algebraic equations in those parameters. 16 refs.; 2 tabs.

1895 (JINR-E-11-91-352) **Approximation formulae for functional integrals in $P(\Phi)_2$-quantum field theory.** Lobanov, Yu.Yu.; Zejnalova, O.V.; Zhidkov, E.P. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Computing Techniques and Automation. 1991. 22p. Order Number DE93606067. Source: OSTI; NTIS (US Sales Only); INIS.

The approximation formulas for functional integrals with Gaussian measure in $P(\Phi)_2$ - quantum field theory are constructed. The formulas are exact on a class of polynomial functionals. Under determined conditions the convergence of approximations to exact value of the integral is proved, the speed of convergence is estimated. 17 refs.; 1 fig.; 4 tabs.

1896 (JINR-R-2-91-315) **Integrals of motion on the group of invariance of an interval in three-dimensional spaces.** Lukac, I. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Theoretical Physics. 1991. 23p. (In Russian). Order Number DE93606090. Source: OSTI; NTIS (US Sales Only); INIS.

The six parametrical group of motion of three-dimensional spaces with arbitrary constant metric conserving the square of distance between two points (the group of invariance of an interval) is considered. The special attention is paid to the group of transformations of an arbitrary homogeneous three-dimensional quadric which is a subgroup of the group of invariance of an interval. The Riemann geometry of this group space is studied and its geometrical characteristics (metric, Riemann's and Ricci's tensors, curvature etc.) are determined. The complete set of the integrals of motion on the group of invariance of an interval in three-dimensional spaces is found. The square of momentum, square of total angular momentum, helicity and square of spin are induced in the set of observables. 12 refs.

1897 (SLAC-PUB-5874) **CP violation.** Nir, Y. (Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Physics). Stanford Linear Accelerator Center, Menlo Park, CA (United States). Sep 1992. 54p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00515. (WIS-92/167/Sep-PH;CONF-9207140-1: Stanford Linear Accelerator Center (SLAC) summer institute on particle accelerators: third family and the physics of flavor, Stanford, CA (United States), 13-24 Jul 1992). Order Number DE93001771. Source: OSTI; NTIS; INIS; GPO Dep.

We review the phenomenology of CP violation. the first part is a general discussion of CP violation in meson decays and in fermion electric dipole moments. The second part describes CP violation in in the Standard Model. The third part describes CP violation beyond the Standard Model. Our discussion is free of phase conventions and uses one language for the K and B systems, which gives further insight into the advantages of measuring CP violation in the β system.

6622 Specific Theories and Interaction Models; Particle Systematics

Refer also to citation(s) 1433, 1833, 1844, 1849, 1927, 1969, 1970, 1971, 2049

1898 (ANL/CP-77129) **Schwinger Dyson equations: Dynamical chiral symmetry breaking and confinement.** Roberts, C.D. Argonne National Lab., IL (United States). [1992]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9206280-1: Workshop on QCD vacuum structure, Paris (France), 1-5 Jun 1992). Order Number DE92040717. Source: OSTI; NTIS; INIS; GPO Dep.

A representative but not exhaustive review of the Schwinger-Dyson equation (SDE) approach to the nonperturbative study of QCD is presented. The main focus is the SDE for the quark self energy but studies of the gluon propagator and quark-gluon vertex are also discussed insofar as they are important to the quark SDE. The scope of this article is the application of these equations to the study of dynamical chiral symmetry breaking, quark confinement and the phenomenology of the spectrum and dynamics of QCD.

1899 (DOE/ER/40546-T2) **Theoretical particle physics: Progress report, FY 1992.** California Univ., San Diego, La Jolla, CA (United States). 30 Sep 1992. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG03-90ER40546. Order Number DE93000649. Source: OSTI; NTIS; INIS; GPO Dep.

This report discusses the following topics: heavy quark physics; Chiral Perturbation theory; Skyrmions; quarkonia and nuclear matter; parity violating nuclear matrix elements; how precisely can one determine M_U/M_D; weak scale baryogenesis; constraints of baryogenesis form neutrino masses; majorons, double beta decay, supernova 1987A; rare decays; chiral lattice fermions; Pauli-Villars regulator and the Higgs mass bound; and Higgs and Yukawa interactions.

1900 (DOE/ER/40682–13) **Oblique electroweak corrections from heavy scalar fields.** Li, Ling-Fong. Carnegie-Mellon Univ., Pittsburgh, PA (United States). Dept. of Physics. [1992]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-91ER40682. (CMU-HEP–92-18). Order Number DE93002646. Source: OSTI; NTIS; INIS; GPO Dep.

The contributions of heavy scalar fields to the oblique electroweak correction parameters S and T are discussed with an emphasis of the decoupling properties of these contributions. It turns that in the decoupling limit, we also get the custodial symmetry.

1901 (DOE/ER/40698–1) **Experimental investigations of strong interactions in non-perturbative QCD region: Annual progress report, January 16, 1992–January 15, 1993.** Lindenbaum, S.J.; Samuel, S. City Coll., New York, NY (United States). Dept. of Physics. 9 Sep 1992. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-92ER40698. Order Number DE92041153. Source: OSTI; NTIS; INIS; GPO Dep.

We have experimentally investigated the reactions $\pi^- p \rightarrow \phi\phi n$ (OZI forbidden), $\phi K^+K^- n$ (OZI allowed), $K^- p \rightarrow \phi\phi\{\sigma^\lambda\}$ (OZI allowed), $\phi K^+K^-\{\sigma^\lambda\}$(OZI allowed), $\bar{p}p \rightarrow \phi\,\phi\,\pi^0$ (OZI forbidden), $\phi K^+K^-\pi^0$ (OZI allowed). By comparing the OZI forbidden (glueball filter) reactions with the OZI allowed and taking a global view we hope to critically test our hypothesis that the g_T (2010), $g_{T'}$ (2300), and g_T''(2340) all with $I^GJ^{PC} = 0^+2^{++}$ are produced by 1–3 2^{++} glueballs. We have searched for a Quark-Gluon Plasma by using 14.6 GeV/c x A Si ions incident on Au, Cu and Si. The novel detector used was a large solid angle TPC system. Although we found considerable strangeness enhancement this is explainable by conventional cascade physics including N* production. We have been engaged in phenomenological analyses in both glueball and heavy ion work. We have found that the θ(1720) is the same as the 0^{++} f_0(1720) we discovered earlier. Furthermore that the G(1590) can be explained as a sum of the f_0(1400) and f_0(1720) and does not require a new resonant state. We have also found that the strangeness enhancement discovered in heavy ion collisions so far is explainable by conventional physics. We are in the STAR Collaboration at RHIC which uses a large TPC system to search for a Quark-Gluon Plasma.

1902 (IC–92/153) **Baryonic currents and their correlators in the heavy quark effective theory.** Grozin, A.G. (Budker Inst. of Nuclear Physics, Novosibirsk (Russian Federation)); Yakovlev, O.I. International Centre for Theoretical Physics, Trieste (Italy). Jul 1992. 19p. Order Number DE93604313. Source: OSTI; NTIS (US Sales Only); INIS.

HQET currents with the quantum numbers of the ground-state baryons are discussed. One-loop anomalous dimensions are calculated, and exact one-loop matching to QCD currents is found. Two-point correlators of these currents ar calculated taking into account $d \leq 9$ terms of the OPE. Sum rules for heavy baryons Λ_Q and $\Sigma_Q^{(*)}$ are analyzed. Three-point correlators of two baryonic currents and a heavy-heavy velocity changing current are calculated with the same accuracy. The baryonic Isgur-Wise form factors are estimated from the corresponding sum rules. (author). 27 refs, 7 figs.

1903 (IC–92/155) **Effective four-fermion interactions and dynamical breaking of electroweak symmetry.** Zhou Bangrong. International Centre for Theoretical Physics, Trieste (Italy). Jul 1992. 13p. Order Number DE93604256. Source: OSTI; NTIS (US Sales Only); INIS.

A general research on the Nambu-Jona-Lasinio mechanism is conducted in the bubble approximation and the feasibility of minimal dynamical breaking of the electroweak gauge group $SU_L(2)xU_Y(1)$ induced by four-fermion interactions among one generation of fermions is expanded. The configurations of allowed composite Higgs and Goldstone bosons depend on the ratio between two independent four-fermion coupling constants and can be simply read out from the four-fermion Lagrangian. The implication of many-generation extension of the research for the fine-tuning problem is conceived. (author). 6 refs.

1904 (IC–92/164) **Flavour democracy calls for the fourth generation.** Datta, A. International Centre for Theoretical Physics, Trieste (Italy). Jul 1992. 9p. Order Number DE93604257. Source: OSTI; NTIS (US Sales Only); INIS.

It is argued with the help of an illustrative mode, that the inter species hierarchy among the fermion masses and the quark mixing angles can be accommodated naturally in the standard model with (approximate) flavour democracy provided there are four families of sequential quark-leptons with all members of the fourth family having roughly equal masses. The special problem of light neutrino masses (if any) and possible solutions are also discussed. (author). 15 refs.

1905 (IC–92/186) **Bethe-Salpeter equation for non-self conjugate mesons in a power-law potential.** Ikhdair, S.M. International Centre for Theoretical Physics, Trieste (Italy). Jul 1992. 10p. Order Number DE93606104. Source: OSTI; NTIS (US Sales Only); INIS.

We develop an approach to the solution of the spinless Bethe-Salpeter equation for the different-mass case. Although the calculations are developed for spin-zero particles in any arbitrary spherically symmetric potential, the non-Coulombic effective power-law potential is used as a kernel to produce the spin-averaged bound states of the non-self-conjugate mesons. The analytical formulae are also applicable to the self-conjugate mesons in the equal-mass case. The flavor-independent case is investigated in this work. The calculations are carried out to the third-order correction of the energy series. Results are consistent with those obtained before. (author). 14 refs, 1 tab.

1906 (IC–92/193) **Majoron models and the Higgs search.** Joshipura, A.S. (International Centre for Theoretical Physics, Trieste (Italy)); Rindani, S.D. International Centre for Theoretical Physics, Trieste (Italy). Aug 1992. 10p. Order Number DE93606092. Source: OSTI; NTIS (US Sales Only); INIS.

If the SU(2) x U(1) model is extended by adding a complex singlet spin-zero field and a spontaneously broken global U(1) symmetry, a Higgs scalar can decay into a pair of Goldstone bosons. This decay could dominate over the conventional decay modes into fermion-antifermion pairs. If that happens, then the standard Higgs search through its ZZ^*H coupling would not be able to detect the Higgs allowing it to be lighter than implied by the already existing limits from the LEP data on e^+e^- annihilation. Detailed restriction on the Higgs mass and other parameters of the model are derived using the existing LEP data on the standard model Higgs search in the mass region 10-50 GeV. (author). 13 refs, 2 figs.

1907 (INIS-BR–2934, pp. 1-15) **Supersymmetric theories and finiteness.** Helayel-Neto, J.A. (Centro Brasileiro de Pesquisas Fisicas (CBPF), Rio de Janeiro, RJ (Brazil)). Sociedade Brasileira de Fisica, Rio de Janeiro, RJ (Brazil). 1989. 350p. (CONF-8909489–: 10. National Meeting on Physics of Particles and Fields, Itatiaia (Brazil), 20-24 Sep 1989). In *Proceedings of the 10. National Meeting on Physics of Particles and Fields.* Order Number DE93604123. Source: OSTI; NTIS (US Sales Only); INIS.

We attempt here to present a short survey of the all-order finite Lagrangian field theories known at present in four-and two-dimensional space-times. The question of the possible relevance of these ultraviolet finite models in the formulation of consistent unified frameworks for the fundamental forces is also addressed to. (author).

1908 (INIS-BR–2934, pp. 211-234) **Searching quark-gluon plasma in heavy ion reactions.** Kodama, T. (Centro Brasileiro de Pesquisas Fisicas (CBPF), Rio de Janeiro, RJ (Brazil)). Sociedade Brasileira de Fisica, Rio de Janeiro, RJ (Brazil). 1989. 350p. (In Portuguese). (CONF-8909489–: 10. National Meeting on Physics of Particles and Fields, Itatiaia (Brazil), 20-24 Sep 1989). In *Proceedings of the 10. National Meeting on Physics of Particles and Fields.* Order Number DE93604123. Source: OSTI; NTIS (US Sales Only); INIS.

A review of recent results of analysis and experiments on ultra-relativistic heavy ion reactions is done. (M.C.K.).

1909 (INIS-mf–13349, pp. 5) **Investigating of QCD at kp,electromagnetic and weak interactions.** Zoomordian, Ibrahim (Meshed Univ., (Iran) Physics Group). Iranian Physics Society, Teheran (Iran, Islamic Republic of). 1991. 53p. (In Persian).

(CONF-9109417–: Iran's physics conference, Isfahan (Iran, Islamic Republic of), 10 Sep 1991). In *Abstract of articles from Iran's physics conference.* Order Number DE93000811. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. QUANTUM CHROMODYNAMICS/electromagnetic interactions; QUANTUM CHROMODYNAMICS/kaon-proton interactions; QUANTUM CHROMODYNAMICS/weak interactions

1910 (INIS-mf–13358, pp. 10) **Recent developments in the physics of neutrinos.** Nir, Yossi (Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Physics). Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Physics. 1992. 169p. (CONF-9204195–: 1992 Israel Physical Society annual meeting, Rehovot (Israel), 15 Apr 1992). In *Israel physical society 1992 annual meeting: Program and abstracts.* Order Number DE93604079. Source: OSTI; NTIS (US Sales Only); INIS.

Abstract only. STANDARD MODEL/neutrinos; NEUTRINOS

1911 (INIS-mf–13358, pp. 76) **Pair production in a strong electric field.** Kluger, Yuval (Tel Aviv Univ. (Israel). Sackler Faculty of Exact Sciences). Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Physics. 1992. 169p. (CONF-9204195–: 1992 Israel Physical Society annual meeting, Rehovot (Israel), 15 Apr 1992). In *Israel physical society 1992 annual meeting: Program and abstracts.* Order Number DE93604079. Source: OSTI; NTIS (US Sales Only); INIS.

Abstract only. PAIR PRODUCTION/electric fields

1912 (INIS-mf–13358, pp. 70) **Quark solitons as costituents of hadrons.** Ellis, John (European Physical Society, Geneva (Switzerland)); Frishman, Yitzak; Hanay, Amihay; Karliner, Marek. Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Physics. 1992. 169p. (CONF-9204195–: 1992 Israel Physical Society annual meeting, Rehovot (Israel), 15 Apr 1992). In *Israel physical society 1992 annual meeting: Program and abstracts.* Order Number DE93604079. Source: OSTI; NTIS (US Sales Only); INIS.

Abstract only. SOLITONS/quantum chromodynamics; HADRONS; SOLITONS

1913 (JINR-E–2-90-569) **Higgs-Higgs interaction up to higher orders of perturbation theory in the standard model 1: Self-energy and vertex diagrams.** Dvoeglazov, V.V. (Saratovskij Gosudarstvennyj Univ., Saratov (Russian Federation)); Kikot', V.I.; Skachkov, N.B. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Theoretical Physics. 1990. 25p. Order Number DE93606093. Source: OSTI; NTIS (US Sales Only); INIS.

The self-energy and vertex blocks that enter in the Higgs-Higgs amplitude in the fourth order of perturbation theory in the framework of $SU(2)_L xU(1)$ gauge theory with an arbitrary number of fermions are calculated. The form of the corresponding counter terms is found. The calculations are done in an unitary gauge. The renormalization scheme is analogous to that suggested by Sirkin. 12 refs.; 14 figs.

1914 (JINR-E–2-90-570) **Higgs-Higgs interaction up to higher orders of perturbation theory in the standard model 2: Box diagrams and one-loop amplitude.** Dvoeglazov, V.V. (Saratovskij Gosudarstvennyj Univ., Saratov (Russian Federation)); Kikot', V.I.; Skachkov, N.B. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Theoretical Physics. 1990. 15p. Order Number DE93606094. Source: OSTI; NTIS (US Sales Only); INIS.

The Higgs-Higgs amplitude up to the fourth order of perturbation theory is calculated in the framework of $SU(2)_L xU(1)$ gauge theory with an arbitrary number of fermions. The renormalization scheme is analogous to that suggested by Sirlin. The calculations are done in a unitary gauge. 10 refs.; 7 figs.

1915 (JINR-E–2-91-95) **Spin-dependent structure functions of sea quarks in the framework of nonperturbative QCD and new Regge trajectory.** Dorokhov, A.E. (Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Theoretical Physics); Kochelev, N.I. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Theoretical Physics. 1991. 7p. Order Number DE93606105. Source: OSTI; NTIS (US Sales Only); INIS.

Within the model of QCD vacuum as an instanton liquid the spin-dependent structure functions of sea quarks are obtained. It is shown that the EMC data manages the definition of new Regge trajectory connected with the axial anomaly. The model explains the modern experimental data on the sea quark structure functions. 23 refs.; 3 figs.

1916 (JINR-E–2-91-393) **Low-energy predictions of SUSY GUTs: minimal versus finite model.** Kazakov, D.I. (Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Theoretical Physics); Kondrashuk, I.N. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Theoretical Physics. 1991. 19p. Order Number DE93606095. Source: OSTI; NTIS (US Sales Only); INIS.

Submitted to Int. J. Mod. Phys. A.

The low-energy predictions are considered for $\sin^2\Theta_W$ and proton lifetime of SUSY GUTs along the lines of paper. Special attention is paid to the dependence on the mass spectrum of superpartners and possible heavy inhabitants of the Great desert. The minimal and finite SUSY SU(5) models with light and heavy t-squark and additional higgsino are considered. It is shown that modern precise LEP data are naturally reproduced within the finite SUSY SU(5) GUT. 15 refs.; 2 figs.; 1 tab.

1917 (JINR-E–2-91-517) **Standard model without Higgs particles.** Kovalenko, S.G. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems. 1991. 14p. Order Number DE93606096. Source: OSTI; NTIS (US Sales Only); INIS.

A modification of the standard model of electroweak interactions with the nonlocal Higgs sector is proposed. Proper form of nonlocality makes Higgs particles unobservable after the electroweak symmetry breaking. They appear only as a virtual state because their propagator is an entire function. We discuss some specific consequences of this approach comparing it with the conventional standard model. 12 refs.

1918 (JINR-R–2-91-322) **Role of mixed state in statistical models of deconfinement.** Kadantseva, E.P.; Shanenko, A.A.; Yukalov, V.I. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Theoretical Physics. 1991. 14p. (In Russian). Order Number DE93606100. Source: OSTI; NTIS (US Sales Only); INIS.

The deconfinement in nonstratified mixtures of the gluon plasma and glueballs (the SU(2) and SU(3) cases), and of the quark-gluon plasma and hadrons is investigated. The confinement in these systems is found do be a phase transition of second order or of first order close to second order. Taking into account the heterophase states allows us to obtain the results that are in a good agreement with lattice calculations. 39 refs.; 8 figs.

1919 (JINR-R–4-91-447) **The ring electromagnetic model of the charged lepton.** Matora, I.M. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems. 1991. 4p. (In Russian). Order Number DE93606097. Source: OSTI; NTIS (US Sales Only); INIS.

The earlier proposed ring model of charged leptons of the electron and muon has been predicted. The choice of only one model parameter leads to the coicidence of the model characteristics with the existing data on both particles. 5 refs.

1920 (LU-TP–92-8) **Multiplicity distributions in QCD cascades.** Gustafson, G. Lund Univ. (Sweden). Dept. of Theoretical Physics. Mar 1992. 29p. Order Number DE93604290. Source: OSTI; NTIS; INIS.

Multiplicity distributions for hadrons and for jets are studied in QCD parton cascades. The colour dipole formalism is used and earlier results in the double log approximation are generalized to include terms which are suppressed by colour factors or factors of ln s. The result is a set of coupled differential equations, together with appropriate boundary conditions.

1921 (NIKHEF-H/K–92-01) **Nucleon structure functions from deep inelastic muon scattering.** Botje, M.A.J. (Nationaal Inst. voor Kernfysica en Hoge-Energiefysica (NIKHEF), Amsterdam (Netherlands). Sectie H). NIKHEF-H - NIKHEF-K - Collaboration. Nationaal Inst. voor Kernfysica en Hoge-Energiefysica (NIKHEF), Amsterdam (Netherlands). 1992. 10p. (CONF-9203154–: 27. Rencontres de Moriond, QCD and high energy hadronic interactions,

Les Arcs (France), 22-28 Mar 1992). Order Number DE93604291. Source: OSTI; NTIS; INIS.

The New Muon Collaboration has measured deep inelastic muon scattering simultaneously on hydrogen and deuterium at incident muon energies of 90 and 280 GeV. The data cover a wide kinematic range $0.008<x<0.7$ and $0.8<Q^2<50$ GeV^2. Preliminary results are presented on the nucleon structure functions F_2^p and F_2^d. In the region of kinematic overlap the data are in good agreement with previous results from SLAC and BCDMS ($x>0.07$) but disagree with those obtained from a recent analysis of the NMC data. Good agreement is found between theory and data. The flavour non-singlet and singlet quark distributions as well as the gluon distribution are extracted with good precision down to low values of x (0.008). These results are compared to low-x extrapolations based on recent parton distribution fits. Also given is a preliminary result on the strong coupling constant α_S. 16 refs.; 7 figs.

1922 (RAL–92-030) **Reexamining the fermion mass relations in the supersymmetric SU(4)xO(4) GUT model.** Ranfone, S.F. Rutherford Appleton Lab., Chilton (United Kingdom). May 1992. 12p. Order Number DE93604260. Source: OSTI; NTIS (US Sales Only); INIS.

We study in detail the charged fermion masses in the context of the minimal Grand Unified Theory (GUT)- version of the supersymmetric SU (4) "x" O (4) model. We show how the presence of vacuum expectation values (VEVs) of the order of the GUT mass scale for the right-handed (RH) sneutrinos may modify the "naive" equality of the charged-lepton and the down-quark masses at $M_G = 10^{16}$ GeV. In particular, we indicate how one can successfully modify the problematic low-energy relation between m_e and m_μ, while preserving the good prediction $m_b/m_\tau = r \simeq 2.7$ (r being the renormalization parameter). The fact that the VEVs of the RH sneutrinos are predicted to be of order $\approx M_G$, may also have interesting consequences in the mechanism of symmetry breaking of the model. (Author).

1923 (RAL–92-035) **A novel scenario for neutrino masses in superstring-inspired GUT models.** Ranfone, S.; Papageorgiu, E. Rutherford Appleton Lab., Chilton (United Kingdom). Jun 1992. 7p. Order Number DE93606098. Source: OSTI; NTIS (US Sales Only); INIS.

It is shown that the usual "super-suppression" of the standard neutrino masses in the context of the SU(4) x O(4) and the flipped SU(5) x U(1) models may be avoided in the presence of large vacuum expectation values (VEV's) of order M_{GUT} for the right-handed sneutrinos, which have been introduced as a means to improve the mass relations between the down-type quarks and the charged leptons in the first of the two models. (author).

6623 Specific Interactions, Decays and Processes

Refer also to citation(s) 1299, 1885, 1897, 1958, 2030

1924 (ANL-HEP-TR–92-59) **Estimates of rates and errors for measurements of direct-γ and direct-γ + jet production by polarized protons at RHIC.** Beddo, M.E.; Spinka, H.; Underwood, D.G. Argonne National Lab., IL (United States). High Energy Physics Div. 14 Aug 1992. 58p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE92041108. Source: OSTI; NTIS; INIS; GPO Dep.

Studies of inclusive direct-γ production by pp interactions at RHIC energies were performed. Rates and the associated uncertainties on spin-spin observables for this process were computed for the planned PHENIX and STAR detectors at energies between $\sqrt{s}$ = 50 and 500 GeV. Also, rates were computed for direct-γ + jet production for the STAR detector. The goal was to study the gluon spin distribution functions with such measurements. Recommendations concerning the electromagnetic calorimeter design and the need for an endcap calorimeter for STAR are made.

1925 (BNL–47885) **The status of investigations of 0^{++} and 2^{++} glueball states and new searches for exotic hybrid and glueball states.** Lindenbaum, S.J. (City Coll. of New York, NY (United States)). Brookhaven National Lab., Upton, NY (United States). [1992]. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016 ;FG02-92ER40698. (CONF-920837–5: 26. international conference on high energy physics, Dallas, TX (United States), 6-12 Aug 1992). Order Number DE92041312. Source: OSTI; NTIS; INIS; GPO Dep.

A coupled channel analysis of the $J^P = O^{++}$ and 2^{++} channels has been performed and will be further refined. The most prominent glueball candidates to date have been found in these channels. In the O^{++} channel the SLAC $\theta(1720)$ has the same quantum numbers and parameters as the $S^*(1710)$, a state discovered earlier at BNL. Thus for the purposes of this analysis they are assumed to be the same particle. In this analysis, which requires the minimum number of poles to fit the data, the G(1590) is not necessary and the experimental data in various channels can be represented by an overlapping mixture of the $f_0(1400)$ and the $f_0(1720)$. This coupled channel analysis is limited to energies below 2 GeV since there is not data in a sufficient number of channels above 2 GeV to do a coupled channel analysis. The only glueball candidates above 2 GeV are the $g_T(2010)$, $g_T'(2300)$ and $g_T''/1(2340)$ and they only appear in the $\phi\phi$ decay channel (an OZI forbidden channel). It is found that three meson poles for O^{++} and four meson poles for 2^{++} are the minimum necessary to fit the data. The various phase motions and data fits supporting the conclusions of Ref. 3 will be presented and discussed and the present status of the analysis presented. A BNL/CCNY/Fermilab/RPI collaboration is at present measuring at 8 GeV/c beam incident on hydrogen $K^-p \rightarrow \phi\phi\ (\Sigma^\Lambda)$, $p\bar{p} \rightarrow \phi\phi\pi^0$ and $\pi^- p \rightarrow \phi\phi n$. The above channels where one or both ϕ's are replaced by a K^+K^- pair are also observed. The object is to search for glueball(s) and exotic hybrids by comparing OZI forbidden and allowed channels. A description of this experiment and a status report will be made.

1926 (CRN–92-15) **Study of D^* charmed meson production in Z^0 boson decays observed by the DELPHI experiment at LEP.** Benedic, D. Strasbourg-1 Univ., 67 (France). Centre de Recherches Nucleaires; Strasbourg-1 Univ., 67 (France). Dec 1991. 121p. (In French). Order Number DE93721015. Source: OSTI; NTIS (US Sales Only); INIS.

The work presented in this thesis has been performed on the DELPHI experiment, at the CERN large electron-positron collider LEP. The main purpose of this thesis is the study of charmed mesons D^* produced in the hadronic decays of the Z neutral. At first we will describe the theoretical framework by presenting the Standard Model, the fragmentation models and the heavy quark physics. The DELPHI detector is then described and especially the track detectors which are the main detectors in our analysis. Two studies of charged D^* mesons are then presented. In the first one around 170 D^{*+} decaying into D neutral π^+ were reconstructed, where the D neutral decays into $K^-\pi^+$ or $K^-\pi^+\pi^-\pi^+$. From the $X_E = E(D^{*+})/E_{beam}$ distribution, the production rate of D^{*+} in Z neutral hadronic decays is computed. Fixing the b quark fragmentation function, the D^{*+} rate from charm quark and the average $\langle X_E \rangle_c$ are measured. The partial width Γ_c is also measured. The following results were obtained: $Br(Z_{had} \rightarrow D^{*+}X)$. B_*B_o = (4.54 +- 0.54 (stat) $\pm$ 0.55(syst)).10^{-3} $\langle X_E \rangle_c = 0.51 \pm 0.03$(stat) $\pm$ 0.02(syst) $\Gamma_c/\Gamma_{had} = 0.157 \pm 0.031$(stat) $\pm$ 0.041(syst) where B_*B_o is the product $Br(D^{*+} \rightarrow D$ neutral $\pi^+).Br(D$ neutral $\rightarrow K^-\pi^+)$. In the second study the production rate of cantic events is derived from the inclusive analysis of charged pions coming from the decay of charmed mesons $D^{*+} \rightarrow D$ neutral π^+ where the π^+ is constrained by kinematics to have a low P_T with respect to the jet axis. The amount of D^{*+} counted by this method is ten times greater than in the first study. We have thus measured: $\Gamma_c/\Gamma_{had} = 0.122 \pm 0.011$stat $\pm$ 0.028(syst).

1927 (DOE/ER/40389–75) **Experimental investigations in particle physics at intermediate energies: [Annual] performance report, December 1, 1991–November 30, 1992.** Auerbach, L.B.; Highland, V.L.; McFarlane, K.W.; Kettell, S.H. Temple Univ., Philadelphia, PA (United States). Dept. of Physics. 12 Jul 1992. 32p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-88ER40389. Order Number DE93000406. Source: OSTI; NTIS; INIS; GPO Dep.

The major emphasis of this project continues to be on fundamental symmetries and parameters of the Standard Model. A test of a quark model prediction was also done. The projects in the current

period have been the following: LSND, a neutrino oscillation experiment at LAMPF; E791, a search for the decays $K_L^0 \rightarrow \mu e$ and $K_L^0 \rightarrow ee$; E871, tests and preparations for an upgrade proposal; and E888, a search for the H dibaryon. The LSND (Large Scintillator Neutrino Detector) is under construction at this time. Progress in the construction schedule has been accelerated with the expectation of being ready to accept beam in March 1993. The automated system for testing photomultiplier tubes is in full production, and should be able to certify a fun complement of tubes for installation by October 1992. Results of an earlier LAMPF experiment, E764, on the interaction of muon neutrinos with carbon nuclei have been submitted for publication. A thorough 'blind' analysis of the E791 data set has just been brought to completion. Final results for the upper limits (90% C.L.) on the branching ratios for the decays $K_L^0 \rightarrow \mu e$ and $K_L^0 \rightarrow ee$ are 3.3×10^{-11} and 4.1×10^{-11}, respectively. The final result for the branching ratio for $K_L^0 \rightarrow \mu\mu$ from all the data (720 events) is $(7.0 \pm 0.4 \pm 0.2) \times 10^{-9}$. The potential of the E791 detector for rare K decays has reached its limit. Before disassembly it was used to mount a search (E888) for a possible long-lived six-quark state, the H. At the same time studies have been made of an upgraded version of the experiment (E871) that will make use of a portion of the existing apparatus.

1928 (DOE/ER/40662–1) **Experimental and theoretical high energy physics research: Annual progress report, September 1, 1991–September 31, 1992.** California Univ., Los Angeles, CA (United States). Dept. of Physics. [1992]. 111p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG03-91ER40662. Order Number DE93001495. Source: OSTI; NTIS; INIS; GPO Dep.

Progress in the various components of the UCLA High-Energy Physics Research program is summarized, including some representative figures and lists of resulting presentations and published papers. Principal efforts were directed at the following: (I) UCLA hadronization model, PEP4/9 e^+e^- analysis, $\bar{P}$ decay; (II) ICARUS and astroparticle physics (physics goals, technical progress on electronics, data acquisition, and detector performance, long baseline neutrino beam from CERN to the Gran Sasso and ICARUS, future ICARUS program, and WIMP experiment with xenon), B physics with hadron beams and colliders, high-energy collider physics, and the ϕ factory project; (III) theoretical high-energy physics; (IV) H dibaryon search, search for $K_L^0 \rightarrow \pi^0\gamma\gamma$ and $\pi^0\nu\bar{\nu}$, and detector design and construction for the FNAL-KTeV project; (V) UCLA participation in the experiment CDF at Fermilab; and (VI) VLPC/scintillating fiber R & D.

1929 (DOE/ER/40682–6) **CP violation in the decays $B^0 \rightarrow \Psi K_s$ and $B^0 \rightarrow \pi^+\pi^-$: A probe for new physics.** Soares, J.M.; Wolfenstein, L. Carnegie-Mellon Univ., Pittsburgh, PA (United States). Dept. of Physics. 27 May 1992. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-91ER40682. (CMU-HEP–92-11). Order Number DE93002413. Source: OSTI; NTIS; INIS; GPO Dep.

We point out the strong correlation between the CP-violating asymmetries in the decays $B^o \rightarrow \Psi K_s$ and $B^o \rightarrow \pi^+\pi^-$ that is predicted by the Kobayashi-Maskawa model. This results in a very restricted allowed region for the asymmetries, and so their measurement will provide a powerful test of the standard model. To show how new physics may give very different results, we look at the predictions of a simple model where both the standard model and superweak contributions to the K^o and B^o mass matrices coexist. We find that, for possible values of the parameters, practically any values are allowed for the asymmetries.

1930 (DOE/ER/40682–7) **General results for the decays $D \rightarrow \pi\ell\nu$ and $B \rightarrow \pi\ell\nu$.** Wolfenstein, L. (Washington Univ., Seattle, WA (United States). Inst. for Nuclear Theory). Carnegie-Mellon Univ., Pittsburgh, PA (United States). Dept. of Physics. [1992]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-91ER40682. (CMU-HEP–92-12). Order Number DE93002412. Source: OSTI; NTIS; INIS; GPO Dep.

Results are given for the two form factors for $D \rightarrow \pi\ell\nu$ and $B \rightarrow \pi\ell\nu$ at the soft pion limit. The derivation depends only on pion PCAC and heavy quark spin symmetry. The usefulness of these results is discussed.

1931 (FNAL/C–92/232) **High energy elastic and diffractive scattering.** Shukla, S. Fermi National Accelerator Lab., Batavia, IL (United States). Aug 1992. 30p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. (CONF-9206292–1: International conference on physics in collisions, Boulder, CO (United States), 9-12 Jun 1992). Order Number DE93000762. Source: OSTI; NTIS; INIS; GPO Dep.

The developments in high energy pp and $p\bar{p}$ elastic scattering in the last 30 years are summarized. The Regge pole model and the geometrical models are reviewed and their agreement with experimental data discussed. The experimental method for measuring the total cross section and the ratio of the real to the imaginary part of the forward elastic scattering amplitude, p, is described. The asymptotic behavior of the total cross section at high energy is discussed in the light of the new results on $p\bar{p}$ elastic scattering at $\sqrt{s}$=1.8 TeV. Predictions from geometrical models and Regge phenomenology are compared with experimental data. The 2-gluon model of the Pomeron by Low and Nussinov is discussed. Future measurements on elastic pp and $p\bar{p}$ elastic scattering are discussed.

1932 (IC–92/156) **Composite vector leptoquarks in e^+e^-, γe, and $\gamma\gamma$ colliders.** Cieza Montalvo, J.E. (Sao Paulo Univ., SP (Brazil). Inst. de Fisica). International Centre for Theoretical Physics, Trieste (Italy). Jul 1992. 25p. Order Number DE93604385. Source: OSTI; NTIS (US Sales Only); INIS.

We study the signals for composite vector leptoquarks in e^+e^- colliders (LEP II, NLC and CLIC) through their effects on the production of jet pairs, as well as their single and pair productions. We also analyze their production in γe and $\gamma\gamma$ collisions. (author). 12 refs, 8 figs.

1933 (IC–92/161) **The $\eta \rightarrow \pi^0\gamma\gamma$ decay in chiral perturbation theory at the quark level.** Ivanov, A.N. (State Technical Univ., St. Petersburg (Russian Federation)); Troitskaya, N.I.; Nagy, M. International Centre for Theoretical Physics, Trieste (Italy). Jul 1992. 10p. Order Number DE93604361. Source: OSTI; NTIS (US Sales Only); INIS.

The partial width of the $\eta \rightarrow \pi^0\gamma\gamma$ decay is calculated within the chiral perturbation theory at the quark level $(CHPT)_q$, exploiting the linear realization of chiral U(3)xU(3) symmetry: $\Gamma(\eta \rightarrow \pi^0\gamma\gamma)_{(CHPT)_q} = (0.24 \pm 0.05)$ eV. The result is not compared with the experimental one $\Gamma(\eta \rightarrow \pi^0\gamma\gamma)_{exp} = (0.85 \pm 0.19)$ eV. It is confirmed that despite the essential progress of the experimental measurement of the $\eta \rightarrow \pi^0\gamma\gamma$ decay the necessity of the remeasuring of $\Gamma(\eta \rightarrow \pi^0\gamma\gamma)$, proposed by Ebert and Volkov in 1979, is still actual. (author). 12 refs, 2 figs.

1934 (IC–92/185) **Neutrino oscillations and a new Faraday effect.** Anwar Mughal, M.; Ahmed, K. International Centre for Theoretical Physics, Trieste (Italy). Jul 1992. 18p. Order Number DE93606111. Source: OSTI; NTIS (US Sales Only); INIS.

By analogy with the classical Faraday effect for the electromagnetic waves, a Faraday effect for massive neutrinos is found to be a somewhat generic description of neutrino oscillations when the neutrinos traverse a dense medium with or without a magnetic field. We further plot the Faraday angle for the solar neutrino problem as an illustration of the fact that the Faraday effect may yield a conceptually convenient parametrization of various neutrino oscillation scenarios. (author). 8 refs, 3 figs.

1935 (INIS-BR–2934, pp. 125-182) **Phenomenology.** Garcia C, C.A. (La Plata Univ. Nacional (Argentina). Dept. de Fisica). Sociedade Brasileira de Fisica, Rio de Janeiro, RJ (Brazil). 1989. 350p. (In Spanish). (CONF-8909489–: 10. National Meeting on Physics of Particles and Fields, Itatiaia (Brazil), 20-24 Sep 1989). In *Proceedings of the 10. National Meeting on Physics of Particles and Fields*. Order Number DE93604123. Source: OSTI; NTIS (US Sales Only); INIS.

A general view of the state-of-the-art on experimental physics of elementary particles is presented. (M.C.K.).

1936 (INIS-mf–13358, pp. 71) **Nonstrange isovector two-body decay modes of heavy mesons sensitive tests for annhilation contributions and final state interactions.** Lipkin, Harry J. (Weizmann Inst. of Science, Rehovoth (Israel). Dept. of

Physics). Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Physics. 1992. 169p. (CONF-9204195--: 1992 Israel Physical Society annual meeting, Rehovot (Israel), 15 Apr 1992). In *Israel physical society 1992 annual meeting: Program and abstracts.* Order Number DE93604079. Source: OSTI; NTIS (US Sales Only); INIS.

Abstract only. MESONS/decay; MESONS; DECAY; TWO-BODY PROBLEM

1937 (INIS-mf-13358, pp. 75) **Isospin, Shmisospin, CP, and CPT in heavy meson decays: How differnt partial widths combine to give same total widths.** Lipkin, Harry J. (Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Physics). Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Physics. 1992. 169p. (CONF-9204195--: 1992 Israel Physical Society annual meeting, Rehovot (Israel), 15 Apr 1992). In *Israel physical society 1992 annual meeting: Program and abstracts.* Order Number DE93604079. Source: OSTI; NTIS (US Sales Only); INIS.

Abstract only. MESONS/decay; CP INVARIANCE; MESONS; DECAY

1938 (IYaF-90-136) **Parton's picture of the electroweak processes in high energy e^+e^--collisions.** Ivkin, A.V.; Nazirov, M.T.; Ping Wang; Kuraev, E.A. AN SSSR, Novosibirsk (Russian Federation). Inst. Yadernoj Fiziki. 1991. 16p. Order Number DE93606107. Source: OSTI; NTIS (US Sales Only); INIS.

Radiative corrections are taken into account in principle to all orders of perturbation theory. Polarized and unpolarized cases are considered. Estimations of number of W^{+-}, W^+W^-, Z produced are given. 10 refs.

1939 (IYaF-90-147) **E^+e^--annihilation into hadrons and exclusive τ decays.** Ehjdelman, S.I.; Ivanchenko, V.N. AN SSSR, Novosibirsk (Russian Federation). Inst. Yadernoj Fiziki. 1991. 13p. Order Number DE93606108. Source: OSTI; NTIS (US Sales Only); INIS.

New calculations of the branching ratios of the τ-lepton hadronic decays are presented based on the whole bulk of data on electron-positron annihilation into hadrons. Perspectives of future measurements of hadronic cross sections in Novosibirsk are discussed. 28 refs.

1940 (IYaF-91-67) **Minimal embedding of vector mesons into the low-energy effective chiral Lagrangian.** Kuraev, E.A.; Silagadze, Z.K. AN SSSR, Novosibirsk (Russian Federation). Inst. Yadernoj Fiziki. 1991. 13p. Order Number DE93606123. Source: OSTI; NTIS (US Sales Only); INIS.

The work is aimed at studying the possibility of vector meson introduction to low-energy Lagrangian and phenomenologic application of vector meson dominance principles. Mathematic mechanism of vector meson minimal embedding to low-energy effective chiral lagrangian is considered. 15 refs.

1941 (IYaF-91-71) **Pion pair production in photon-photon collisions.** Blinov, A.E. (and others); Blinov, V.E.; Bondar, A.E. AN SSSR, Novosibirsk (Russian Federation). Inst. Yadernoj Fiziki. 1991. 23p. Order Number DE93606114. Source: OSTI; NTIS (US Sales Only); INIS.

The process $\gamma\gamma \to \pi^+\pi^-$ has been measured with the detector MD-1 at VEPP-4. The two-photon reactions of e^+e^-, $\mu^+\mu^-$ and $\pi^+\pi^-$ pair production were separated using scintillation counters, Cherenkov counters and shower-range chambers. The radiation width $\Gamma_{\gamma\gamma}$ $f_2(1270)$=3.1±0.35±0.35 keV has been obtained. 27 refs.; 9 figs.

1942 (JINR-E-2-91-358) **On the subtleties of the spectrum of light meson resonances 1: The model.** Govorkov, A.B. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Theoretical Physics. 1991. 12p. Order Number DE93606119. Source: OSTI; NTIS (US Sales Only); INIS.

It is found that the spectrum of radial and orbital excitations (with LS=0) of light mesons evaluated on the basis of a relativized potential quark model is consistent with experimentally observed resonances. The only exception is the radial excitation of K*(892). 5 refs.; 4 tabs.

1943 (JINR-E-2-91-359) **On the subtleties of the spectrum of light meson resonances 2: II. Data analysis.** Govorkov, A.B. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Theoretical Physics. 1991. 14p. Order Number DE93606120. Source: OSTI; NTIS (US Sales Only); INIS.

A renewed analysis of the available experimental data on e^+e^--annihilation into $\pi\omega$ and $\pi^+\pi^-\pi^0$ hints at the existence of a superfluous $\rho\omega$(1200)-resonances, nonstrange partners of K*(1410). 10 refs.; 1 fig.; 4 tabs.

1944 (JINR-E-2-91-360) **Coupled-channel analysis of low energy nucleon-antinucleon interactions.** Henner, V.K. (Moskovskij Gosudarstvennyj Univ., Moscow (Russian Federation). Fizicheskij Fakul'tet); Meshcheryakov, V.A. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Theoretical Physics. 1991. 20p. Order Number DE93606115. Source: OSTI; NTIS (US Sales Only); INIS.

Submitted to Z. Phys. The Talk Given at Nucleon-antinucleon Conference (NAN 91), July 10, ITEP, Moscow, USSR.

Multichannel M-matrix method is applied to an NN-bar-system with taking into account elastic pp-bar-scattering, charge-exchange pp-bar→nn-bar reaction and pp-bar annihilation. It is shown that contrary to standard assumptions the isotopic invariance due the large influence of the charge exchange channel affects very significantly the parameters of strong interactions. Contrary to previous descriptions, M-matrix elements are treated as real functions. The differential and total cross-sections for pp-bar→pp-bar and pp-bar→nn-bar processes, cross-section δ_{tot}(pp-bar) and the real-to-imaginary ratio of the forward amplitude of elastic pp-bar scattering up to beam momenta p_{lab}=600 MeV/c are described. The fitting leads to a resonance in the s-wave at about p_{lab}=500 MeV/c and to bound states in p-wave near the pp-bar threshold. 33 refs.; 8 figs.; 3 tabs.

1945 (JINR-E-2-91-405) **Naive model of electromagnetic structure of octet baryons.** Dubnickova, A.Z.; Dubnicka, S.; Strizenec, P. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Theoretical Physics. 1991. 15p. Order Number DE93606124. Source: OSTI; NTIS (US Sales Only); INIS.

The structural three-resonance vector dominance model in a zero-width approximation with a strick Okulo-Zweig-lizuks rule consideration is used to parametrize Dirac abd Pauli electromagnetic form factors of octet baryons. In view of the simplicity of the model the obtained results on mean-square electric and magnetic radii of baryons are encoraging. 26 refs.; 2 tabs.

1946 (JINR-E-2-91-451) **Semileptonic decays of D- and B-mesons in the relativistic quark model.** Faustov, R.N. (Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Theoretical Physics); Galkin, V.O.; Mishurov, A.Yu. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Theoretical Physics. 1991. 13p. Order Number DE93606117. Source: OSTI; NTIS (US Sales Only); INIS.

The relativistic corrections to the semileptonic decay form factors of B- and D-mesons are calculated. The obtained form factors of the semileptonic decay agree with the experimental data. 25 refs.; 2 figs.; 1 tab.

1947 (JINR-E-2-91-465) **Determination of the strange quarks's contribution to the proton spin in semi-inclusive deep inelastic electroproduction of K and π mesons.** Alizade, V.N. (AN Azerbajdzhanskoj SSR, Baku (Azerbaijan). Inst. Fiziki); Efremov, A.V. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Theoretical Physics. 1991. 10p. Order Number DE93606112. Source: OSTI; NTIS (US Sales Only); INIS.

A possibility of extracting pure contribution of s-quarks to the proton spin in the processes 1+A->1+h+X A=p,nN; h=K^+,K^0,K^0,π^+ show that measurements of the quantities $\delta\sigma^K$ and δv^π. 10 refs.; 1 fig.

1948 (JINR-E-2-91-475) **Towards the results of global analysis of data on nucleon electromagnetic structure.** Bilen'kaya, S.I.; Dubnicka, S.; Dubnickova, A.Z.; Strizenec, P. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Theoretical Physics. 1991. 14p. Order Number DE93606125. Source: OSTI; NTIS (US Sales Only); INIS.

Peculiar features of the recent global analysis of data on the nucleon electromagnetic structure are discussed on the detail in order to reconsider reliability of the predicted result that the electron-positron annihilation into a neutron-antineutron cross-section is considerably larger that the cross-section of the electron-positron annihilation into a proton-antiproton pair. 14 refs.; 3 figs.; 3 tabs.

1949 (JINR-E-7-91-365) **Investigation of β-delayed neutron emission and elastic scattering of neutron-rich isotopes of He and Li.** Skobelev, N.K.; Lukanov, S.M.; Penionzhkevich, Yu.E.; Sokol, E.A.; Tret'yakova, S.P. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Reactions. 1991. 12p. Order Number DE93606121. Source: OSTI; NTIS (US Sales Only); INIS.

One of the methods to obtain lightest neutron-rich nuclei as secondary beams is described. Secondary beams are formed a nuclear reaction due to heavy ions with the energy of ~20 MeV/nucleon. The data analysis of the measured elastic cross-section shows, that the peripheral ^{9}Li interaction region has a rather high transparency. Strong dynamical polarization of the ^{9}Li nucleus in the field of the heavy nucleus of ^{208}Pb in the process of scattering is proposed. 24 refs.; 6 figs.; 3 tabs.

1950 (LAL–92-21) **Study of jet production in H1 detector at HERA. Application to $\alpha_s(Q^2)$ determination.** Devel, M. Paris-11 Univ., 91 - Orsay (France). Lab. de l'Accelerateur Lineaire. May 1992. 174p. (In French). Order Number DE93721028. Source: OSTI; NTIS (US Sales Only); INIS.

Measuring the fractions of events with a given number of hadronic jets should enable the HERA physicists to observe the evolution of α_s as a function of Q^2, hence to measure Λ_{QCD}. For that purpose, after a study of the calorimeter performances, we have developed a jet-finding algorithm, optimized so that it excludes the remnants of the proton from the jet making process. With this algorithm, the ratio of the number of events with two reconstructed jets over the number of events with one reconstructed jet has been studied. A clear dependence with Λ_{QCD} and Q^2 is observed. We have then defined a kinematic zone in which the acceptance corrections are below a few percent and the reconstruction of the kinematic variables well under control: $0.01 \leq x \leq 0.1$; $200\ GeV^2 \leq Q^2 \leq 9840\ GeV^2$. Using an integrated luminosity of 100 pb^{-1}, we find that, in this zone, it will be possible to measure Λ_{QCD} with a statistical error of the order of 3%. Moreover, with the same luminosity and points in the (x,Q^2) plane defined with a precision of 10%, one should observe the evolution of α_s with a statistical precision $\delta\alpha_s$ of the order of 0.03.

1951 (LAL–92-26) **New results on direct CP violation from the NA31 experiment.** Perdereau, O. NA31 Collaboration. Paris-11 Univ., 91 - Orsay (France). Lab. de l'Accelerateur Lineaire; Paris-11 Univ., 91 - Orsay (France). May 1992. 8p. (CONF-9203197–: 27. Rencontres de Moriond: 'Electroweak Interactions and Unified Theories', Les Arcs (France), 15-22 Mar 1992). Order Number DE93721704. Source: OSTI; NTIS (US Sales Only); INIS.

The NA31 experiment has published the first evidence for direct CP violation by measuring a non-zero value for the $Re(\epsilon'/\epsilon)$ parameter. Further data-taking periods took place in 1988 and 1989, producing two datasets with statistics comparable to the original one. This paper presents the final result of the analysis of the 1988 dataset together with a preliminary result of the analysis of the 1989 one. The Combined, preliminary, measurement of NA31 is $Re(\epsilon'/\epsilon) = (2.3 \pm 0.7)\ 10^{-3}$, thus confirming our initial measurement and also in agreement with the standard model.

1952 (PCCF-RI–92-07) **Heavy quark production and decay at LEP.** Falvard, A. Clermont-Ferrand-2 Univ., 63 - Aubiere (France). Lab. de Physique Corpusculaire. 1992. 72p. (In French). (CONF-9109440–: 23. School on Particle Physics: Electroweak properties of heavy quarks, Palaiseau (France), Sep 1991). Order Number DE93721002. Source: OSTI; NTIS (US Sales Only); INIS.

This lesson is divided in 3 parts. In the first part, tests of electroweak Standard Model that can be performed in studying the Z → b anti b,c anti c coupling are presented. The second part shows the possibilities of B anti B mixing measurement and which statistics is necessary to have significant results. And finally, in the last part, the author looks after which are the possibilities to have interesting results about the life time measurement of beauty hadrons.

1953 (PCCF-T–91-01) **Experimental study of pions plus on the proton at threshold. Contribution at nucleon axial form factor measurement.** Elouadrhiri, L. Clermont-Ferrand-2 Univ., 63 - Aubiere (France). Lab. de Physique Corpusculaire. May 1991. 137p. (In French). Order Number DE93721004. Source: OSTI; NTIS (US Sales Only); INIS.

We are in the process of measuring the nucleon axial form factor, $g_A(k^2)$, using pion electroproduction at threshold for the four-momentum transfers of -1.8, -3.5, -5.0 fm^{-2}. The electron and pion have been detected in coincidence. The reconstructed missing mass of the neutron identifies the reaction. The experiment used the electron beam of the Linear Accelerator of Saclay (ALS) and a liquid hydrogen target. A complete detection arm for low energy pions was designed and built for this experiment. After justifying the motivations of our experiment, we present a detailed description of the experimental apparatus and its methods, as well as the process used to reconstruct the pion momentum. We explain in details the experimental conditions during data taking and the analysis method, which consists in extracting very small cross sections from a large background. Finally we present the complete set of cross sections for the lowest four-momentum transfer: $-1.8fm^{-2}$. 31 figs., 15 tabs.

1954 (RAL–92-021) **New information on parton distributions.** Martin, A.D. (Durham Univ. (United Kingdom). Dept. of Physics); Stirling, W.J.; Roberts, R.G. Rutherford Appleton Lab., Chilton (United Kingdom). Apr 1992. 49p. (DTP–92/16.). Order Number DE93604340. Source: OSTI; NTIS (US Sales Only); INIS.

New data on structure functions from deep-inelastic scattering provide new information on parton distributions, particularly in the $0.01 < x < 0.1$ interval. This has important implications for predictions for the HERA ep collider and for present and future high energy hadron colliders. We present the results of updated fits to all available precision structure function and related data. We focus in particular on two issues: the increase in the sea quark distributions at small x implied by new F_2 data from the New Muon Collaboration (NMC) and its implications for other processes, and the evidence for SU(2) symmetry breaking in the light quark sea. We show that although good fits can be obtained with or without this symmetry breaking, more physically reasonable parton distributions are obtained if we allow d-bar > u-bar at small x. With the inclusion of the latest deep-inelastic data we find $\alpha_s(M_Z) = 0.111^{+0.004}_{-0.005}$. We also show how W, Z and Drell-Yan production at p-barp colliders can give information on parton distributions. (Author).

1955 (RAL–92-037) **Analysing $\gamma\gamma \to \pi\pi$ and what it can tell us.** Morgan, D. Rutherford Appleton Lab., Chilton (United Kingdom). Jun 1992. 12p. Order Number DE93606113. Source: OSTI; NTIS (US Sales Only); INIS.

To appear in Proc. Photon-photon '92 (9. International workshop on photon-photon collisions), San Diego, CA (US), 22-26 Mar 1992.

Among $\gamma\gamma$ reactions, the process $\gamma\gamma \to \pi\pi$ is particularly favoured for amplitude analysis. The combination of quite detailed data on both charge channels and exceptionally prescriptive theoretical constraints allows a full prediction of the low energy cross-section and a detailed amplitude analysis through the $f_2(1270)$ region. Key issues that may thereby be explored are the coupling to $\gamma\gamma$ of the broad I = 0 S-wave resonance and, the capacity of precise low energy $\gamma\gamma \to \pi\pi$ data to refine our knowledge of the $\pi\pi$ I = 0 scattering length, a_0^0. (author).

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Refer also to citation(s) 1818, 1845, 1857, 1906, 1925, 1938, 1947, 2088

1956 (CEA-LNS-Ph–92-17) **Excitation of the Roper resonance and study of higher baryon resonances.** Morsch, H.P. (Laboratoire National Saturne, Centre d'Etudes de Saclay, 91 - Gif-sur-Yvette (France)). Laboratoire National Saturne, Centre d'Etudes

de Saclay, 91 - Gif-sur-Yvette (France). 1992. 12p. (CONF-9205256–: 6. SATURNE days, Mont Sainte-Odile (France), 18-22 May 1992). Order Number DE93721699. Source: OSTI; NTIS (US Sales Only); INIS.

The region of the P_{11} resonance N(1440) is investigated in inelastic α-scattering on hydrogen using alpha-particles from Saturne with a beam momentum of 7 GeV/c. In the missing mass spectra of the scattered α-particles two effects are observed, excitation of the projectile, preferentially excited to the Δ-resonance, and excitation of the Roper resonance. The large differential cross sections indicate a structure of a compression mode. From this the compressibility of the nucleon K_N may be extracted. The Roper resonance excitation corresponds to a surface mode which may be related to an oscillation of the meson cloud. The other monopole mode which corresponds to a vibration of the valence quarks should lie at about 800 MeV of excitation or above. This is the region of the P_{11}(1710 MeV) resonance. Therefore experiments are important to measure the monopole strength in this energy region. Another interesting aspect is the scalar polarizability which can be extracted from inelastic dipole excitations (squeezing modes) as excitation energies above 500 MeV.

1957 (DOE/ER/40546–T1) **Studies in theoretical particle physics: Progress report.** Kaplan, D.B. California Univ., San Diego, CA (United States). 1 Aug 1992. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG03-90ER40546. Order Number DE93000648. Source: OSTI; NTIS; INIS; GPO Dep.

This report focuses on research on three distinct areas of particle physics: Chiral Fermions on the Lattice; Weak Scale Baryogenesis; analysis of parity violating nuclear forces, and other an attempt to render the electric dipole moment of the neutron immune from quantum gravity corrections.

1958 (IC–92/196) **Planck scale effects in neutrino physics.** Akhmedov, E.Kh. (International Centre for Theoretical Physics, Trieste (Italy)); Senjanovic, G.; Tao Zhijan; Berezhiani, Z.G. International Centre for Theoretical Physics, Trieste (Italy). Aug 1992. 22p. (SISSA–140/92/EP;LMU–09/92.). Order Number DE93606133. Source: OSTI; NTIS (US Sales Only); INIS.

We study the phenomenology and cosmology of the Majoron (flavon) models of three active and one inert neutrino paying special attention to the possible (almost) conserved generalization of the Zeldovich-Konopinski-Mahmoud lepton charge. Using Planck scale physics effects which provide the breaking of the lepton charge, we show how in this picture one can incorporate the solutions to some of the central issues in neutrino physics such as the solar and atmospheric neutrino puzzles, dark matter and a 17 keV neutrino. These gravitation effects induce tiny Majorana mass terms for neutrinos and considerable masses for flavons. The cosmological demand for the sufficiently fast decay of flavons implies a lower limit on the electron neutrino mass in the range of 0.1-1 eV. (author). 32 refs, 1 fig., 1 tab.

1959 (IN2P3–92-02) **Where is the Higgs-boson.** Cahn, R.; Froidevaux, D.; Grivaz, J.F.; King, S.F.; Mansoulie, B.; Taxil, P. Institut National de Physique Nucleaire et de Physique des Particules (IN2P3), 75 - Paris (France). 1990. 360p. (In French, English). (CONF-9009441–: Summer school of particle physics, Strasbourg (France), 3-7 Sep 1990). Order Number DE93720939. Source: OSTI; NTIS (US Sales Only); INIS.

The 22th session of Summer School on Particle Physics was held in Strasbourg from 3 to 7 September 1990. The subject 'Where is the Higgs' and all aspects of this question have been studied in lessons and discussions: actual researches of Higgs at LEP in the Standard Model or not, future researches in hadron collisions of very high energy and hard technical problems that the experiments set near to the future hadron colliders.

1960 (IN2P3–92-02, pp. 5-99) **A Higgs primer.** Cahn, R.N. (Lawrence Berkeley Lab., CA (United States)). Institut National de Physique Nucleaire et de Physique des Particules (IN2P3), 75 - Paris (France). 1990. (In French, English). Contract DE-ACO3.76SF00098. (CONF-9009441–: Summer school of particle physics, Strasbourg (France), 3-7 Sep 1990). In *Where is the Higgs-boson.* 360p. Order Number DE93720939. Source: OSTI; NTIS (US Sales Only); INIS.

The orthodox Higgs boson of the Standard Model is presented in a pedagogical fashion with an audience of experimentalists in mind, beginning with a presentation of spontaneously broken gauge theories. Basic calculations of decay rates to fermion-antifermion, to WW and ZZ, and $\gamma\gamma$ are displayed in detail. Production cross sections for Higgs bosons in both e^+e^- and proton-proton collisions are calculated. Special attention is given to processes that might be observed at LEP II, the LHC, or the SSC. The t antit condensate model is discussed and some elementary computations presented. The effect of a heavy Higgs boson on the W - Z mass splitting is determined.

1961 (IN2P3–92-02, pp. 101-143) **Higgs bosons beyond Minimal Standard Model.** Taxil, P. (Centre National de la Recherche Scientifique (CNRS), 13 - Marseille (France). Centre de Physique Theorique). Institut National de Physique Nucleaire et de Physique des Particules (IN2P3), 75 - Paris (France). 1990. (In French). (CONF-9009441–: Summer school of particle physics, Strasbourg (France), 3-7 Sep 1990). In *Where is the Higgs.* 360p. Order Number DE93720939. Source: OSTI; NTIS (US Sales Only); INIS.

This lesson covers some points of view of Higgs Bosons physics beyond the Minimal Standard Model: Minimal Supersymmetry Standard Model, non-minimal supersymmetric models, non supersymmetric models.

1962 (IN2P3–92-02, pp. 147-197) **Alternatives to Higgs scalars.** King, S. (Southampton Univ. (United Kingdom). Dept. of Physics). Institut National de Physique Nucleaire et de Physique des Particules (IN2P3), 75 - Paris (France). 1990. (In French). (CONF-9009441–: Summer school of particle physics, Strasbourg (France), 3-7 Sep 1990). In *Where is the Higgs.* 360p. Order Number DE93720939. Source: OSTI; NTIS (US Sales Only); INIS.

We discuss alternatives to the Higgs Scalar doublet Φ of the minimal standard model. In particular we review technicolor (TC) and extended technicolor (ETC), and show that the threat of flavour changing neutral currents (FCNC's) is avoided by walking TC and/or strongly coupled ETC. The phenomenology of minimal TC and the techni-family is discussed. Finally we consider the possibility that the Higgs doublet Φ is a composite bound state of quarks from the third (or fourth) family.

1963 (IN2P3–92-02, pp. 199-246) **Higgs boson research in e^+e^- collisions.** Grivaz, J.F. (Paris-11 Univ., 91 - Orsay (France). Lab. de l'Accelerateur Lineaire). Institut National de Physique Nucleaire et de Physique des Particules (IN2P3), 75 - Paris (France). 1990. (In French). (CONF-9009441–: Summer school of particle physics, Strasbourg (France), 3-7 Sep 1990). In *Where is the Higgs.* 360p. Order Number DE93720939. Source: OSTI; NTIS (US Sales Only); INIS.

This lesson is about the experimental results obtained in 1990, at LEP concerning Higgs boson research. The main topics studied are: Higgs boson research of minimal Standard Model, then beyond the minimal model, the charged Higgs boson research in 2-doublets model, and finally, neutral Higgs boson research in a specific 2-doublets model, the minimal supersymmetric standard model.

1964 (INIS-BR–2934, pp. 183-210) **Spin of proton.** Epele, L.N. (La Plata Univ. Nacional (Argentina). Dept. de Fisica). Sociedade Brasileira de Fisica, Rio de Janeiro, RJ (Brazil). 1989. 350p. (In Spanish). (CONF-8909489–: 10. National Meeting on Physics of Particles and Fields, Itatiaia (Brazil), 20-24 Sep 1989). In *Proceedings of the 10. National Meeting on Physics of Particles and Fields.* Order Number DE93604123. Source: OSTI; NTIS (US Sales Only); INIS.

Information on proton spin conformation are obtained from analyses of the deep inelastic scattering (DIS) of polarized muons by polarized proton targets. (M.C.K.).

1965 (INIS-BR–2934, pp. 244-248) **Spinning self-dual particles.** Gamboa, J. (Sao Paulo Univ., SP (Brazil). Inst. de Fisica); Rivelles, V.O. Sociedade Brasileira de Fisica, Rio de Janeiro, RJ

(Brazil). 1989. 350p. (In Portuguese). (CONF-8909489--: 10. National Meeting on Physics of Particles and Fields, Itatiaia (Brazil), 20-24 Sep 1989). In *Proceedings of the 10. National Meeting on Physics of Particles and Fields.* Order Number DE93604123. Source: OSTI; NTIS (US Sales Only); INIS.

Self-dual particles in two-dimensions are presented. They were obtained from chiral boson particle by square root technique. The propagator of spinning self-dual particle is calculated using the BFV formalism. (M.C.K.).

1966 (INIS-BR--2934, pp. 249-252) **Dynamic breaking of parity and spin anomaly in (2+1) dimensions.** Gomes, M. (Sao Paulo Univ., SP (Brazil). Inst. de Fisica); Rivelles, V.O.; Silva, A.J. da. Sociedade Brasileira de Fisica, Rio de Janeiro, RJ (Brazil). 1989. 350p. (In Portuguese). (CONF-8909489--: 10. National Meeting on Physics of Particles and Fields, Itatiaia (Brazil), 20-24 Sep 1989). In *Proceedings of the 10. National Meeting on Physics of Particles and Fields.* Order Number DE93604123. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. FERMIONS/parity; FERMIONS/spin; FERMIONS; PARITY; SPIN; MANY-DIMENSIONAL CALCULATIONS; PARTICLE INTERACTIONS

1967 (INIS-mf--13358, pp. 73) **Implications of EMC and G_A/G_V for Baryon structure.** Lipkin, Harry J. (Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Physics). Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Physics. 1992. 169p. (CONF-9204195--: 1992 Israel Physical Society annual meeting, Rehovot (Israel), 15 Apr 1992). In *Israel physical society 1992 annual meeting: Program and abstracts.* Order Number DE93604079. Source: OSTI; NTIS (US Sales Only); INIS.

Abstract only. BARYONS/structural models; BARYONS

1968 (INIS-mf--13358, pp. 74) **Bose-Einstein correlations for mixed neutral mesons.** Lipkin, Harry J. (Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Physics). Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Physics. 1992. 169p. (CONF-9204195--: 1992 Israel Physical Society annual meeting, Rehovot (Israel), 15 Apr 1992). In *Israel physical society 1992 annual meeting: Program and abstracts.* Order Number DE93604079. Source: OSTI; NTIS (US Sales Only); INIS.

Abstract only. MESONS/bose-einstein statistics; MESONS

1969 (IYaF--90-123) **Electric dipole moment of the W-boson and the electron in the Kobayashi-Maskawa model.** Khriplovich, I.B.; Pospelov, M.E. AN SSSR, Novosibirsk (Russian Federation). Inst. Yadernoj Fiziki. 1991. 10p. Order Number DE93606137. Source: OSTI; NTIS (US Sales Only); INIS.

In the Kobayashi-Maskawa model electric dipole moments of the W-boson and the electron do not arise in the two-loop and three-loop approximations respectively. 8 refs.; 9 figs.

1970 (IYaF--90-138) **Nonperturbative correction to the threshold production of t anti t-pairs.** Fadin, V.S.; Yakovlev, O.I. AN SSSR, Novosibirsk (Russian Federation). Inst. Yadernoj Fiziki. 1991. 13p. Order Number DE93606138. Source: OSTI; NTIS (US Sales Only); INIS.

Calculations are performed of the nonperturbative correction to the cross-section for the tt-pair near the threshold in e^+e^--annihilation, which is connected with the existence of a gluon condensate. These have been made using a constant chromoelectric field approximation. 15 refs.

1971 (IYaF--91-11) **On the Higgs boson contribution to the tt-bar production threshold cross-section.** Fadin, V.S.; Yakovlev, O.I. AN SSSR, Novosibirsk (Russian Federation). Inst. Yadernoj Fiziki. 1991. 6p. Order Number DE93606139. Source: OSTI; NTIS (US Sales Only); INIS.

The correction to the e^+e^-->tt cross section near the threshold which is due to the standard model Higgs exchange is calculated at $m_{Higgs} > m_t$. 8 refs.

1972 (LAL--92-23) **On the determination of a mass lower limit for the Higgs boson in the presence of candidate events.** Grivaz, J.F.; Le Diberder, F. Paris-11 Univ., 91 - Orsay (France). Lab. de l'Accelerateur Lineaire. Apr 1992. 8p. Order Number DE93721703. Source: OSTI; NTIS (US Sales Only); INIS.

A method is presented in which the mass resolution is taken into account to derive a mass lower limit for the neutral Higgs boson when candidate events are retained by the selection cuts.

1973 (LAL--92-27) **Will a Higgs boson be found at future e^+e^- colliders.** Janot, P. Paris-11 Univ., 91 - Orsay (France). Lab. de l'Accelerateur Lineaire; Paris-11 Univ., 91 - Orsay (France). May 1992. 18p. (CONF-9203197--: 27. Rencontres de Moriond: 'Electroweak Interactions and Unified Theories', Les Arcs (France), 15-22 Mar 1992). Order Number DE93721705. Source: OSTI; NTIS (US Sales Only); INIS.

As the search for the standard Higgs boson is reaching its sensitivity limit at LEP 100, now is the time to explore the capabilities of the future e^+e^- colliders in this field. In particular, the second phase of LEP is studied, and the minimum integrated luminosity required for an efficient search up top $m_H \geq m_Z$ is given as a function of the various centre-of-mass energy hypotheses. The $\sqrt{s}$ = 500 GeV Next Linear Collider (NLC) is shown to easily cover the 'intermediate' mass region, $m_Z \geq m_H \geq 200$ GeV/c^2. Finally, the ability of these colliders to fully probe the MSSM via its neutral Higgs sector is demonstrated.

1974 (LAPP-T--90-04) **Study of resonances produced in $\pi^- p \rightarrow (\pi^0\omega)n$ and $(\pi^- p \rightarrow)(\pi^0\pi^0\omega)n$ at 100 GeV.** Bencheikh, B. Grenoble-1 Univ., 74 - Annecy (France). Lab. de Physique des Particules Elementaires. Dec 1990. 120p. (In French). Order Number DE93721024. Source: OSTI; NTIS (US Sales Only); INIS.

Dealing with quark light meson spectroscopy, reactions $\pi^- p \rightarrow (\pi^0\omega) n$, $(\pi^0\pi^0\omega) n$ measured at 100 GeV with the GAMS detector in the Na12 experiment at CERN are analysed. After a short description of the experimental set-up, selection of events and background substraction are discussed. The mass spectrum is dominated by the b_1 and ρ_3 mesons. Analysis of events produced at small momentum transfer shows for the first time the existence of a resonance with quantum numbers $J^{PC} = 1^{--}$, $I^G = 1^+$ at 2.1 GeV. This resonance is compatible with the two vector-mesons expected at 2 GeV in the quark model. A new structure is also observed at high momentum transfer at 1.6 GeV. This could corresponds to a radial excitation of the b_1 meson or to 2^{--} state both expected in the quark model. Study of $\pi^0\pi^0\omega$ selected events indicates clearly the existence on the $(\pi^0 b_1)$ mass spectrum of a structure at 1.9 GeV which is compatible with a hybrid state structure according to certain models based on QCD.

1975 (LA-UR--92-3192) **Neutrino mass and mixing, and non-accelerator experiments.** Robertson, R.G.H. Los Alamos National Lab., NM (United States). [1992]. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-920837--6: 26. international conference on high energy physics, Dallas, TX (United States), 6-12 Aug 1992). Order Number DE93000867. Source: OSTI; NTIS; INIS; GPO Dep.

We review the current status of experimental knowledge about neutrinos derived from kinematic mass measurements, neutrino oscillation searches at reactors and accelerators, solar neutrinos, atmospheric neutrinos, and single and double beta decay. The solar neutrino results yield fairly strong and consistent indication that neutrino oscillations are occurring. Other evidence for new physics is less consistent and convincing.

1976 (LA-UR--92-3194) **On the 17-keV conundrum.** Hime, A. Los Alamos National Lab., NM (United States). [1992]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-9206227--2: 15. international conference on neutrino physics, Granada (Spain), 7-13 Jun 1992). Order Number DE93000866. Source: OSTI; NTIS; INIS; GPO Dep.

Recent developments in pursuance of the 17-keV neutrino are discussed with emphasis upon experiments employing solid state detectors. Studies have shown that electron scattering effects are the likely origin of the anomalies observed in β decay spectra measured at Oxford and Guelph. While missing links remain, it is improbable that a 17-keV neutrino exists in nature and a resolution of this conundrum is within reach.

1977 (LA-UR--92-3208) **The experimental status of neutrino masses and mixings.** Robertson, R.G.H. Los Alamos National Lab., NM (United States). [1992]. 17p. Sponsored by

USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-9206251–2: Physics beyond the standard model III conference, Ottawa (Canada), 22-24 Jun 1992). Order Number DE93000862. Source: OSTI; NTIS; INIS; GPO Dep.

We review the current status of experimental knowledge about neutrinos derived from kinematic mass measurements, neutrino oscillation searches at reactors and accelerators, solar neutrinos, atmospheric neutrinos, and single and double beta decay. The solar neutrino results yield fairly strong and consistent indications that neutrino oscillations are occurring. Other evidence for new physics is less consistent and convincing.

1978 (LBL–32514) **From the ψ to charmed mesons: Three years with the SLAC-LBL detector at SPEAR.** Goldhaber, G. Lawrence Berkeley Lab., CA (United States). Jun 1992. 33p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-9206131–2: 3. international symposium on the history of particle physics - the rise of the standard model, Stanford, CA (United States), 24-27 Jun 1992). Order Number DE93000569. Source: OSTI; NTIS; INIS; GPO Dep.

As I look back at the first three years or so at SPEAR, I consider this one of the most revolutionary or perhaps the most revolutionary, experiment in the 60 year history of particle physics. It certainly was the most exciting time, in a laboratory that is, that I have ever experienced. In my talk I will cover the period 1973–1976 which saw the discoveries of the ψ and ψ' resonances the χ states and most of the Psion spectroscopy, the D^0, D^+ charmed meson doublet as well as the D^{0*} and D^{+*} doublet. I will also refer briefly to some more recent results. Most of the discoveries I will mention were made with the SLAC-LBL Magnetic Detector or "MARK I" which we operated at SPEAR from 1973 to 1976. In 1976 the MARK I was modified to include a "Lead Glass Wall" (LGW) for improved photon and electron detection. This involved a new physics group from LBL, who built the LGW, Lina Barbaro-Galtieri et al. as well as a continuing group from SLAC, Martin Perl and Gary Feldman et al. to provide continuity in the running of the MARK I and to continue the study of the anomalous $e\mu$events which Martin found earlier and which eventually were identified as the signature of the τ lepton.

1979 (PCCF-RI–92-04) **Study of H $\rightarrow \gamma\gamma$ decay.** Causse, M.B.; Dugne, J.J.; Montarou, G. Clermont-Ferrand-2 Univ., 63 - Aubiere (France). Lab. de Physique Corpusculaire. 1992. 22p. (In French). Order Number DE93721706. Source: OSTI; NTIS (US Sales Only); INIS.

The authors study the H $\rightarrow\gamma\gamma$ decay in the Standard model and present the detailed calculation of scattering amplitude of this process involving Feynman diagrams of three points loops. The calculation of these diagrams can be effected in different gauges and involves fermion, gauge boson and phantom loops. The decay width of the process is derived in conclusion.

1980 (PCCF-RI–92-05) **Test of determination of nucleon structure functions in the hypothesis of scalar di-quark existence.** Tavernier, P.; Dugne, J.J. Clermont-Ferrand-2 Univ., 63 - Aubiere (France). Lab. de Physique Corpusculaire. 1992. 33p. (In French). Order Number DE93721026. Source: OSTI; NTIS (US Sales Only); INIS.

The authors present the nucleon structure functions that have been obtained in the hypothesis of existence of a scalar di-quark, progressively broken by increasing energy of electromagnetic probe (Stockolm model). Comparisons with other models and experimental results are presented. 20 figs.

1981 (RAL–92-022) **Effective heavy quark theory.** Close, F.E. (Rutherford Appleton Lab., Chilton (United Kingdom)); Zhenping Li. Rutherford Appleton Lab., Chilton (United Kingdom). May 1992. 8p. Order Number DE93606140. Source: OSTI; NTIS (US Sales Only); INIS.

We show how heavy quark effective theory (HQET), including 1/M_Q corrections, may be matched onto dynamical quark models by making a specific choice of K_μ, m and υ_μ in the $p_\mu = m\upsilon_\mu + K_\mu$ expansion. We note that Wigner rotations of heavy quark spins arise at $O(p^2/m^2)$ in non-relativistic models but at $O(\Delta_{QCD}/M_Q)$ or O(velocity - transfer) in HQET and so are necessary for a consistent treatment. (author).

1982 (UCRL-JC–110734) **Determination of the neutrino mass from the beta decay of gaseous molecular tritium.** Decman, D.J.; Stoeffl, W. Lawrence Livermore National Lab., CA (United States). Jun 1992. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9203162–3: International symposium on spectroscopy and structure of molecules and nuclei, Tallahassee, FL (United States), 27 Mar 1992). Order Number DE93001326. Source: OSTI; NTIS; INIS; GPO Dep.

We set an upper limit of 8 eV for the mass of the electron antineutrino from studying the beta decay of tritium. We use a gaseous molecular tritium source, a high resolution magnetic spectrometer and a low background counting system to minimize the systematic errors encountered in these measurements. Our calibration data with radioactive ^{83m}Kr enables us to measure our system response function and a good deal of atomic physics data. In addition to our end point results we have made the first measurement of the tritium beta decay spectrum below 200 keV. We find an excess of very low energy electrons which arise from molecular processes of the $^3He\text{-}T^+$ ion.

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Refer also to citation(s) 1817, 1835, 1841

1983 (ANL–92/16) **Physics Division annual review, April 1, 1991–March 31, 1992.** Henning, W.F. Argonne National Lab., IL (United States). Aug 1992. 269p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE93003038. Source: OSTI; NTIS; INIS; GPO Dep.

This report contains brief discusses on topics in the following areas: Research at atlas; operation and development of atlas; medium-energy nuclear physics and weak interactions; theoretical nuclear physics; and atomic and molecular physics research.

1984 (DOE/ER/40145–7) **Research in theoretical nuclear physics: Progress report, November 1, 1989–September 1992.** Udagawa, T. Texas Univ., Austin, TX (United States). Dept. of Physics. Sep 1992. 44p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-84ER40145. Order Number DE93001798. Source: OSTI; NTIS; INIS; GPO Dep.

This report discusses topics in the following areas: Low energy nuclear reactions induced by light and heavy ions; medium energy physics; and nuclear structure. (LSP)

1985 (DOE/ER/40256–7) **Neutron multiplicity distributions for 30 MeVu ^{14}N reactions with the indicated targets: Progress in research, April 1, 1991–March 31, 1992.** Texas A and M Univ., College Station, TX (United States). Cyclotron Inst. Jun 1992. 167p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-86ER40256. Order Number DE92040601. Source: OSTI; NTIS; INIS; GPO Dep.

This report contains short papers on the following topics: Heavy ion reactions; nuclear structure and fundamental interactions; nuclear theory; atomic molecular and materials science; and superconducting cyclotron and instrumentation. (LSP)

1986 (GANIL-RA–89-91) **Nuclear physics at Ganil. A compilation 1989-1991.** Grand Accelerateur National d'Ions Lourds (GANIL), 14 - Caen (France). 1991. 229p. Order Number DE93720999. Source: OSTI; NTIS (US Sales Only); INIS.

This compilation deals with experimental and theoretical work performed at GANIL for the 1989-1991 years about the nuclear structure and nuclear reactions. During this period, the accelerator performances have been strongly increased, as well for the delivered energies and intensities as for the span of accelerated ions. In the experimental areas, a totally new data acquisition system has been set up, and the adding of a Wien filter to the Lise spectrometer results now in a versatile and efficient isotope separator, called LISE III. The time structure and the large intensity of the beam were decisive in identifying, for the first time, kaon production in heavy ions collisions at the GANIL subthreshold energies. Nucleons have to undergo several collisions before inducing such a process, and the strange particle emission should be very sensitive to the physical conditions of the hot and compressed interacting zone. Lead and Uranium beams now available at the Fermi energy,

have been used to study the nuclear disassembly of very large and heavy systems. New results have been obtained on the collective flow in heavy ion reactions, giving new insights on the Equation of State problematics. In the field of nuclear structure, the magnetic spectrometer SPEG, coupled with large particle or gamma detectors shed light on new aspects of the giant resonance excitations. Exotic nuclei are extensively studied, with a particular emphasis on the 11Li nucleus. A new method of mass measurement, using the CSS2 as a mass separator, has been successfully tested; it will greatly improve the accuracy achieved on intermediate and heavy nuclei. Last but not least, the theory group is actively working to include fluctuations in the description of the nuclear dynamics and to characterise the onset of the multifragmentation process in heavy ion collisions. Author index and publication list are added.

1987 (INIS-mf–13358, pp. 67) **Induced W_{∞} gravity as a WZNW model on the deformed group of area-preserving diffeomorphism.** Nissimov, E. (Ben-Gurion Univ. of the Negev, Beersheba (Israel). Dept. of Physics); Pacheva, S. Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Physics. 1992. 169p. (CONF-9204195–: 1992 Israel Physical Society annual meeting, Rehovot (Israel), 15 Apr 1992). In *Israel physical society 1992 annual meeting: Program and abstracts.* Order Number DE93604079. Source: OSTI; NTIS (US Sales Only); INIS.

Abstract only. W MINUS BOSONS/gravitational interactions

1988 (IPNO-RA–91) **Annual report 1991.** Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire. 1 Sep 1990. 408p. (In French). Order Number DE93721019. Source: OSTI; NTIS (US Sales Only); INIS.

The 1990-1991 activity report of Nuclear Physics Institute (at Orsay) is presented. The purpose and evolution of research fields are summarized. The following topics are presented: in experimental research, nuclear structure, ground states and low energy excited states, high excitation energy nuclear states, heavy ion collision phenomena, intermediate energy nuclear physics, radiochemistry of lanthanides and actinides and heavy ion interactions material and surface; in theoretical physics, nuclear structure and dynamics, particle physics, field theory, statistical physics, variational principles and quantization of chaotic systems and mathematical methods. The Nuclear Physics Institute works also on the development of several multidetectors (EUROGAM, INDRA, EDEN) and accelerators (AGOR, MACSE, Tandem).

1989 (LBL–31855) **Nuclear Science Division annual report for 1991.** Myers, W.D. (ed.). Lawrence Berkeley Lab., CA (United States). Apr 1992. 184p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. Order Number DE93001537. Source: OSTI; NTIS; INIS; GPO Dep.

This paper discusses research being conducted under the following programs: Low energy research program; bevalac research program; ultrarelativistic research program; nuclear theory program; nuclear theory program; nuclear data evaluation program; and 88-inch cyclotron operations.

1990 (SINS–2106/A) **Nuclear and atomic physics with the accelerators of the nineties: Proceedings of the 21st Mikolajki summer school on nuclear physics held in Mikolajki, Poland, August 26 - September 5, 1990. Seminars.** Sujkowski, Z.; Szeflinska, G. (eds.). Institute of Atomic Energy, Otwock-Swierk (Poland). Nov 1990. 111p. (CONF-900857–: 21. Mikolajki summer school on nuclear physics: nuclear and atomic physics with accelerators of the nineties, Mikolajki (Poland), 26 Aug - 5 sep 1990). Order Number DE93604421. Source: OSTI; NTIS (US Sales Only); INIS.

Separate abstracts were prepared for 19 of the papers presented during seminars or poster sessions. (A.S.).

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Refer also to citation(s) 2014

1991 (CONF-860158–9) **High spin states in ^{183,184}Pt.** Carpenter, M.P. (Tennessee Univ., Knoxville, TN (United States)); Bingham, C.R.; Courtney, L.H.; Juutinen, S.; Larabee, A.J.; Liu, Z.M.; Riedinger, L.L.; Zhang, Z.Y.; Johnson, A.; Nyberg, J.; Baktash, C.; Halbert, M.L.; Johnson, N.R.; Lee, I.Y.; Schutz, Y.Tennessee Univ., Knoxville, TN (United States). [1986]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AS05-76ER04936. From International meeting on nuclear physics; Bormio (Italy); 20-25 Jan 1986. Order Number DE93000582. Source: OSTI; NTIS; GPO Dep.

Data on discrete high spin states in ^{183,184}Pt is presented. In ^{184}Pt an upbend at a rotational frequency of $\hbar\omega \approx 0.25$ MeV is interpreted as an alignment of two $h_{9/2}$ quasiprotons and two $i_{13/2}$ quasineutrons occurring at about the same frequency. The structure of the high spin states in ^{183}Pt, observed for the first time in this experiment, reveal a significant signature splitting in the $\nu i_{13/2}$ band. In this transitional region of nuclei both triaxility and hexadecapole deformations may play a role in affecting the signature splitting.

1992 (CONF-9110289–5) **Rotational band structure of intruder configurations: success and limitations of the Cranked Shell Model.** Wyss, R. Joint Inst. for Heavy Ion Research, Oak Ridge, TN (United States). [1991]. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400 ;FG05-87ER40361. From International symposium on reflections and directions in low energy heavy ion physics; Oak Ridge, TN (United States); 14-15 Oct 1991. Order Number DE93001713. Source: OSTI; NTIS; INIS; GPO Dep.

Rotational bands built on intruder configurations are discussed within the Cranked Shell Model. The experimental observed alignment pattern occurring in these bands cannot be accounted for by standard mean field calculations. The discrepancy between theory and experiment is traced back to the fact that the neutron-proton interaction is only partly and indirectly included in the standard mean field approach.

1993 (CONF-9205108–2) **Low-spin identical bands in odd-A nuclei.** Baktash, C.; Garrett, J.D.; Winchell, D.F.; Smith, A. Oak Ridge National Lab., TN (United States). [1992]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From International conference on nuclear structure at high angular momentum; Ottawa (Canada); 18-21 May 1992. Order Number DE92041016. Source: OSTI; NTIS; INIS; GPO Dep.

A comprehensive study of odd-A rotational bands in normally-deformed rare-earth nuclei indicates that a large number of seniority-one configurations (30% for odd-Z nuclei) at low spin have moments of inertia nearly identical to that of the seniority-zero configuration of the neighboring even-even nucleus with one less nucleon. It is difficult to reconcile these results with conventional models, based on the traditional picture of nuclear pair correlation in vogue for more than three decades, which predict variations of about 15% in the moments of inertia of configurations differing by one unit in seniority.

1994 (DOE/ER/40417–9) **Nuclear structure research: Progress report, August 1, 1991–July 31, 1992.** Brenner, D.S. Clark Univ., Worcester, MA (United States). Jul 1992. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-88ER40417 ;AC02-76CH00016. Order Number DE93000405. Source: OSTI; NTIS; INIS; GPO Dep.

The Clark University research program in nuclear structure is a collaborative effort involving Clark University personnel, staff members from Brookhaven National Laboratory and an active participation of scientists from other nations. The TRISTAN on-line isotope separator and the capture γ-ray facility at the HFBR are the experimental foci of the program which has four principal research themes, three involving nuclear structure physics and one directed towards astrophysics. These themes are: (1) the manifestation of the proton-neutron interaction in the evolution of nuclear structure and its relation to collectivity, (2) the appearance and the role of symmetries and supersymmetries in nuclei, (3) the study of new regions of magic nuclei, and (4) the characterization of nuclei important in r-process stellar nucleosynthesis. The activities involving Clark personnel during the operating period of Grant No. FG02-88ER40417, August 1, 1991–July 31, 1992, are summarized.

1995 (DOE/ER/40561–75) **Semi-empirical mass formula for drops of strange matter and constrains from recent experiments.** Desai, M.S. (Washington Univ., Seattle, WA (United States). Inst. for Nuclear Theory); Shaw, G.L.; Crawford, H.J. Washington Univ., Seattle, WA (United States). Inst. for Nuclear Theory. [1992]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG06-90ER40561 ;AC03-76SF00098. Order Number DE92040074. Source: OSTI; NTIS; INIS; GPO Dep.

Fixed-target experiments with relativistic heavy-ion collisons at BNL and CERN search for small metastable drops of strange matter, S drops. A useful semi-empirical mass formula for S drops is presented here. This mass formula can easily be fitted to the experimental results. The results of an experiment at BNL are used to constrain the parameters.

1996 (DOE/ER/40619–2) **Studies of nuclear structure using neutrons and charged particles: Progress report, 1 September 1991–31 August 1992.** Roberson, N.R. (Triangle Universities Nuclear Lab., Durham, NC (United States)). Triangle Universities Nuclear Lab., Durham, NC (United States); Duke Univ., Durham, NC (United States); North Carolina Univ., Chapel Hill, NC (United States); North Carolina State Univ., Raleigh, NC (United States). 1 Oct 1992. 199p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-91ER40619 ;AC05-76ER01067 ;FG05-88ER40442 ;FG05-88ER40441. Order Number DE93002884. Source: OSTI; NTIS; INIS; GPO Dep.

This report discusses the following topics: fundamental symmetries in the nucleus; internucleon interactions; internucleon dynamics in very light nuclei; the many-nucleon problem; developments in electronuclear physics; and nuclear instruments and methods.

1997 (IN2P3–92-01) **Nuclei in high forms.** Szymanski, Z.; Berger, J.F.; Heenen, P.H.; Heyde, K.; Haas, B.; Janssens, R.; Paya, D.; Gogny, D.; Huber, G.; Bjoernholm, S.; Brack, M. Institut National de Physique Nucleaire et de Physique des Particules (IN2P3), 75 - Paris (France). 1991. 360p. (In French). (CONF-9109278–: International Joliot-Curie summer school of nuclear physics, Maubuissen (France), 16-21 Sep 1991). Order Number DE93720936. Source: OSTI; NTIS (US Sales Only); INIS.

The purpose of 1991 Joliot-Curie Summer School is to review the most advances in the understanding of the nuclei physics after the considerable progress in gamma spectroscopy. It covers the following topics: Highly and super-deformed nuclei, nuclear structures, mean-field approach and beyond, fission isomers, nuclear excitations with long lifetime and metal clusters.

1998 (INIS-BR–2934, pp. 306-312) **Separable potentials and the delta-nucleon interaction.** Ferreira, E. (Pontificia Univ. Catolica do Rio de Janeiro, RJ (Brazil). Dept. de Fisica); Dosch, H.G. Sociedade Brasileira de Fisica, Rio de Janeiro, RJ (Brazil). 1989. 350p. (CONF-8909489–: 10. National Meeting on Physics of Particles and Fields, Itatiaia (Brazil), 20-24 Sep 1989). In *Proceedings of the 10. National Meeting on Physics of Particles and Fields.* Order Number DE93604123. Source: OSTI; NTIS (US Sales Only); INIS.

We obtain rank-one separable potentials with Yamaguchi form factors to describe the ΔN isospin one $^5S_2$ and $^5P_3$ phases which were obtained from the analysis of πd elastic scattering observables. For both waves the separable potentials are attractive, but not strong enough to form bound states, and present range parameters of the order of three times the pion mass. (author).

1999 (IPNO-T–91-07) **Form coexistence in ^{187}Au: study of the populations of oblate and prolate systems.** Korichi, A. Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire. 15 May 1991. 93p. (In French). Order Number DE93721700. Source: OSTI; NTIS (US Sales Only); INIS.

The study of the high-spin states of ^{187}Au shows, for the first time, that the population of the prolate and the oblate systems depends of the reaction and the beam energy. The first experiment of this work was carried out using the ^{160}Gd(^{31}P, 4n) reaction at 145 MeV. This one should bring more angular momentum and then populate higher spin states in comparison with those populated using the ^{172}Yb(^{19}F, 4n) at 95 MeV (up to 57/2h). All these studies were carried out with in beam spectroscopic techniques using the 'Chateau de Cristal' array. No higher spin states were observed in the ^{31}P reaction, however the analysis of the γ-γ coincidences revealed a difference between the population of the prolate and the oblate bands as compared in the ^{19}F reaction. Measurements of the population of prolate and oblate states at different beam energies for both F and P projectiles have been undertaken. The fission cross section has been measured for these two systems at the same energies to see whether or not the fission plays a role. In the other hand, theoretical calculations using the cracking model have been done and the results of these calculations showed that the shape coexistence survives up to spin 40h.

2000 (IPNO-T–92-01) **One nucleon transfer reactions induced by heavy ions: single particles states and collective modes.** Lhenry, I. Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire. Apr 1992. 147p. (In French). Order Number DE93721023. Source: OSTI; NTIS (US Sales Only); INIS.

In one nucleon transfer reactions induced by heavy ion beams, broad and very prominent structures are observed above 10 MeV excitation energy. The aim of this work is to try to understand these structures and to distinguish between interpretations in terms of the excitation of single particles states or collective modes such as giant resonances. We studied one nucleon transfer reactions on different targets ^{207}Pb, ^{209}Bi, ^{59}Co, ^{63}Cu, ^{58}Ni, ^{120}Sn with beams of ^{20}Ne at 48 MeV/A and of ^{36}Ar at 42 MeV/A, detecting reaction products with a magnetic spectrometer, in order to verify the presence of those structures and to measure them in broad range of reactions. The different experimental results show that these bumps cannot be attributed to low multipolarity giant resonances (L=1 or 2). These results have been compared with two very different theoretical approaches. The first one uses a reaction model in order to evaluate the cross section of the different processes that can contribute to the transfer spectra. The second one is based on a microscopic description of the excited states in the random phase approximation (RPA), followed by a cross section calculation in the distorted wave Born approximation (DWBA). In the framework of these models, it appears that the observed structures are dominated by the excitation of high spin single particle states. Nevertheless, a small part of the cross section can be attributed to collective excitations of high multipolarity.

2001 (JINR-E–1-90-591) **Study of relativistic hypernuclei produced in nucleus-nucleus interactions.** Okonov, Eh.O. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of High Energy. 1990. 6p. Order Number DE93606143. Source: OSTI; NTIS (US Sales Only); INIS.

The experiment is proposed to study relativistic hypernuclei produced in nucleus-nucleus interactions using the spectrometer with fast coordinate and charge detectors. The main points of the proposed experimental programm in nuclear beams of the nuclotron are briefly outlined: observation and study of unknown hypernuclei with charge $Z>6$, measurements of their decay lifetimes, investigations of characteristics of their decays as a function of Z, a search for new hypernuclei with strangeness $S\geq 2$ and strange multiquark states as well. 13 refs.; 1 fig.

2002 (JINR-R–2-91-348) **Shell structure calculation method in eikonal theory.** Omboo, Z.; Ehnkhbat, S. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems. 1991. 6p. (In Russian). Order Number DE93606151. Source: OSTI; NTIS (US Sales Only); INIS.

The problem of calculating cross-sections for particle-nucleus interactions is considered in the framework of eikonal approach. In the case of antisymmetrized oscillator functions, the method is developed. Simplifying conditions for calculation of determinants are found. 5 refs.; 1 fig.

2003 (JINR-R–11-91-351) **On a calculation of complex energies of the resonance states.** Zhanlav, T.; Puzynin, I.V. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Computing Techniques and Automation. 1991. 10p. (In Russian). Order Number DE93606150. Source: OSTI; NTIS (US Sales Only); INIS.

The problem of calculation of the resonance states in spherical nuclei is formulated as an eigenvalue one. Two ways of defining a

boundary condition at infinity for a wavefunction are suggested. For solving numerically the obtained eigenvalue problem a modification of the continuous analog of Newton's method is used which allows the resonance energy and wavefunction to be found to a high accuracy. 18 refs.; 1 tab.

2004 (LA-UR–92-3199) **Application of multistep compound and multistep direct models for data evaluation.** Chadwick, M.B.; Young, P.G. Los Alamos National Lab., NM (United States). [1992]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-921046–1: Symposium on nuclear data evaluation methodology, Upton, NY (United States), 12-16 Oct 1992). Order Number DE93000865. Source: OSTI; NTIS; INIS; GPO Dep.

We have implemented the quantum mechanical multistep compound (MSC) and multistep direct (MSD) theories of Feshbach, Kerman, and Koonin (FKK) for the calculation of nucleon-induced multistep reactions. Our code system, FKK-GNASH, uses the FKK theory for primary preequilibrium emission and describes subsequent equilibrium emission using the Hauser-Feshbach code GNASH. The MSC contribution yields emitted particles with angular distributions symmetric about ninety degrees, whereas the MSD contribution, calculated by averaging DWBA cross sections for particle-hole excitations in the continuum, results in forward-peaked preequilibrium emission. The original picture of the evolution of the reaction, as described by FKK, is modified to allow transitions from the MSD to MSC chain. This modification is consistent with semiclassical preequilibrium descriptions, and allows a good description of preequilibrium spectra and angular distributions for a range of different reactions. As an example of our methodology, we calculate ^{93}Nb(n,n') reactions at 14, 20 and 26 MeV, and ^{93}Nb(n,p) at 14 MeV, comparing our results with experimental data. Use of the FKK theory has the advantage that preequilibrium calculations are based on rigorous physical principles, and (unlike semiclassical approaches) allow a good description of angular distributions. We argue that our implementation of the FKK theory maximizes the level of predictability, which is needed for data evaluations.

2005 (LBL–32497) **Tilted cranking classification of multibandspectra.** Frauendorf, S. (IHK FZ-Rossendorf, Dresden (Germany)); May, F.R. Lawrence Berkeley Lab., CA (United States). 19 Jun 1992. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-9205108–15: International conference on nuclear structure at high angular momentum, Ottawa (Canada), 18-21 May 1992). Order Number DE92041187. Source: OSTI; NTIS; INIS; GPO Dep.

The existence of TDHF-solutions rotating uniformly about a non-principal axis of the deformed axial potential is demonstrated. The solutions represent $\Delta I=1$ bands. Selfconsistency and symmetry are discussed. The transformation of experimental spectra to the rotating frame of reference is introduced. Excitation spectra at high spin are calculated and found to agree well with recent data on ^{163}Er and ^{174}Hf.

2006 (LIYaF–1655) **Construction of the wave function of tritium/helium-3 using a method based on the extraction of leading singularities.** Anisovich, A.V.; Anisovich, V.V. AN SSSR, Leningrad (Russian Federation). Inst. Yademoj Fiziki. 1990. 23p. Order Number DE93606144. Source: OSTI; NTIS (US Sales Only); INIS.

In the framework of dispersion presentation of the Faddeev equation a method for plotting wave function of three-particle bound state is suggested. Wave function of tritium/helium-3 with approximation of NN interaction by S wave amplitudes in scattering length approximation was found. Form factor of helium-3 was calculated, its value being in a good agreement with experimental data at $q^2<2$ fm^{-2}. 8 refs.; 6 figs.

2007 (SINS–2106/A, pp. 41-46) **Superdeformed structures in the ^{143,145}Gd isotopes.** OSIRIS-Collaboration, ESSA 30-Collaboration. Institute of Atomic Energy, Otwock-Swierk (Poland). Nov 1990. (CONF-900857–: 21. Mikolajki summer school on nuclear physics: nuclear and atomic physics with accelerators of the nineties, Mikolajki (Poland), 26 Aug - 5 sep 1990). In *Nuclear and atomic physics with the accelerators of the nineties: Proceedings of the 21st Mikolajki summer school on nuclear physics, held in Mikolajki, Poland, August 26 - September 5, 1990. Seminars.* 111p. Order Number DE93604421. Source: OSTI; NTIS (US Sales Only); INIS.

We established a discrete superdeformed (SD) band in Gd consisting of 13 transitions with a quadrupole moment of $Q_0 = 12\pm2$ eb. Indications for the least two additional sequences of SD structure have been observed. We have shown that the triples analysis is a very powerful and sensitive method to detect SD collective correlations in nuclei. We have also shown, that we are approaching the limits of our present day technology. We have to sharpen our spectroscopic tools to be able to explore this new exciting field of nuclear spectroscopy in secondary minima. (author).

2008 (SINS–2106/A, pp. 47-52) **Structure of odd-odd Sb and In nuclei.** Fenyes, T. (Institute of Nuclear Research of the Hungarian Academy of Sciences, Debrecen (Hungary)); Dombradi, Zs.; Gacsi, Z. Institute of Atomic Energy, Otwock-Swierk (Poland). Nov 1990. (CONF-900857–: 21. Mikolajki summer school on nuclear physics: nuclear and atomic physics with accelerators of the nineties, Mikolajki (Poland), 26 Aug - 5 sep 1990). In *Nuclear and atomic physics with the accelerators of the nineties: Proceedings of the 21st Mikolajki summer school on nuclear physics, held in Mikolajki, Poland, August 26 - September 5, 1990. Seminars.* 111p. Order Number DE93604421. Source: OSTI; NTIS (US Sales Only); INIS.

The level structure of $^{118, 116}$Sb and $^{114, 112, 110}$In, $^{108, 106}$In nuclei was studied with complex γ- and e^- -spectroscopic methods via (p, nγ) and in some cases (α, nγ) reactions at different bombarding particle energies between 5 and 17 MeV. Large amount of spectroscopic information has been obtained and significantly extended level schemes have been deduced. The energy spectra and electromagnetic properties of ^{116}Sb, $^{116, 114, 112, 110, 108, 106}$In nuclei were calculated in the framework of the interacting boson-fermion-fermion/odd-odd truncated quadrupole phonon model (IBFFM/OTQM). Numerous p-n multiplet members have been identified. The main systematic trends and observed nuclear structure anomalies have been reasonably described by the theory. (author).

2009 (SINS–2106/A, pp. 58-62) **High spin states in ^{131}Ce.** Palacz, M. (Soltan Inst. for Nuclear Studies, Otwock-Swierk (Poland)); Sujkowski, Z.; Nyberg, J.; Bacelar, J.; Jongman, J.; Urban, W.; Hesselink, W.; Nasser, J.; Plompen, A. Institute of Atomic Energy, Otwock-Swierk (Poland). Nov 1990. (CONF-900857–: 21. Mikolajki summer school on nuclear physics: nuclear and atomic physics with accelerators of the nineties, Mikolajki (Poland), 26 Aug - 5 sep 1990). In *Nuclear and atomic physics with the accelerators of the nineties: Proceedings of the 21st Mikolajki summer school on nuclear physics, held in Mikolajki, Poland, August 26 - September 5, 1990. Seminars.* 111p. Order Number DE93604421. Source: OSTI; NTIS (US Sales Only); INIS.

Gamma ray spectra from the ^{117}Sn(^{18}O,4n)^{131}Ce reaction have been studied with the NORDBALL array of 15 Compton-suppressed Ge detectors. States up to $I = 51/2\hbar$, $E\approx 8$ MeV are populated. Evidence is presented for bands built on three- and possibly five- quasiparticle configurations resulting from the alignment of $h_{11/2}$ neutrons. (author).

2010 (SINS–2106/A, pp. 7-11) **Optical model with critical angular momentum cut off for the fusion of light heavy-ion systems.** Czakanski, J. (Uniwersytet Slaski, Katowice (Poland). Inst. Fizyki); Kisiel, J.; Kostrubiec, M.; Zipper, W.; Brentano, P. von. Institute of Atomic Energy, Otwock-Swierk (Poland). Nov 1990. (CONF-900857–: 21. Mikolajki summer school on nuclear physics: nuclear and atomic physics with accelerators of the nineties, Mikolajki (Poland), 26 Aug - 5 sep 1990). In *Nuclear and atomic physics with the accelerators of the nineties: Proceedings of the 21st Mikolajki summer school on nuclear physics, held in Mikolajki, Poland, August 26 - September 5, 1990. Seminars.* 111p. Order Number DE93604421. Source: OSTI; NTIS (US Sales Only); INIS.

The extended optical potential model with separate absorptive part for fusion and critical angular momentum cut off was proposed for the calculation of fusion excitation functions. As an example a calculated fusion cross section was presented for the ^{12}C + ^{12}C, ^{12}C + ^{14}N, ^{12}C + ^{16}O and ^{16}O + ^{16}O systems for the existing experimental data above Coulomb barrier energy. (author).

2011 (SINS–2106/A, pp. 28-31) **The mean-square charge radii of Ba isotopes.** Nerlo-Pomorska, B. (Uniwersytet Marii Curie-Sklodowskiej, Lublin (Poland). Inst. Fizyki); Pomorski, K.; Skorupska, B. Institute of Atomic Energy, Otwock-Swierk (Poland). Nov 1990. Project CPBP-01.09. (CONF-900857–: 21. Mikolajki summer school on nuclear physics: nuclear and atomic physics with accelerators of the nineties, Mikolajki (Poland), 26 Aug - 5 sep 1990). In *Nuclear and atomic physics with the accelerators of the nineties: Proceedings of the 21st Mikolajki summer school on nuclear physics, held in Mikolajki, Poland, August 26 - September 5, 1990. Seminars.* 111p. Order Number DE93604421. Source: OSTI; NTIS (US Sales Only); INIS.

The microscopic calculations of the mean-square charge radii and the quadrupole moments of Ba isotopes were done. It was shown that the pairing mean field deformation Δ influences strongly the magnitude of the isotopic shift of $< r^2 >$. (author).

2012 (SINS–2106/A, pp. 53-57) **Are there β- and γ-bands in transitional nuclei?.** Gelberg, A. (Koeln Univ. (Germany). Inst. fuer Kernphysik); Lieberz, D.; Lieberz, W.; Brentano, P. von; Sugita, M.; Otsuka, T. Institute of Atomic Energy, Otwock-Swierk (Poland). Nov 1990. (CONF-900857–: 21. Mikolajki summer school on nuclear physics: nuclear and atomic physics with accelerators of the nineties, Mikolajki (Poland), 26 Aug - 5 sep 1990). In *Nuclear and atomic physics with the accelerators of the nineties: Proceedings of the 21st Mikolajki summer school on nuclear physics, held in Mikolajki, Poland, August 26 - September 5, 1990. Seminars.* 111p. Order Number DE93604421. Source: OSTI; NTIS (US Sales Only); INIS.

A comparison of the O(6)-limit of the Interacting Boson Model and of the triaxial rotor model with β-vibration has been carried out for the nucleus ^{126}Xe. The comparison has been extended to include the Rotation Vibration model. In conclusion it was found that the O_2^+ and 2_2^+ states in transitional nuclei can not be interpreted as β-and γ-band heads respectively. (author).

2013 (UCRL-JC–109657) **Oblate collectivity in ^{197,198}Pb.** Kuhnert, A. (Lawrence Livermore National Lab., CA (United States)); Wang, T.F.; Stoyer, M.A.; Becker, J.A.; Henry, E.A.; Brinkman, M.J.; Yates, S.W.; Draper, J.E.; Deleplanque, M.A.; Diamond, R.M.; Stephens, F.S. Lawrence Livermore National Lab., CA (United States). Jul 1992. 6p. Sponsored by USDOE, Washington, DC (United States); National Science Foundation, Washington, DC (United States). DOE Contract W-7405-ENG-48 ;AC03-76SF00098. (CONF-920708–5: 2. international nuclear physics conference, Wiesbaden (Germany), 26 Jul - 1 aug 1992). Order Number DE93001303. Source: OSTI; NTIS; INIS; GPO Dep.

Evidence for collective behavior in the high-spin region of neutron deficient lead nuclei is provided by the observation of four collective structures in ^{197,198}Pb. These bands consist of strong dipole (M1) transitions with a few E2 crossover transitions observed. The transition energies of three of these bands show a rather regular behavior while those of one of them show an irregular behavior. We interpret the regular bands as oblate collective bands built on oblate proton and neutron states, whereas the irregular band might either be built on a state with very small oblate deformation, or be a triaxial rotational band. A lifetime measurement (DSAM) has been done for the regular bands in ^{198}Pb. Neutron and proton configurations for the bands are suggested from the results of quasi particle Routhians and total Routhian surface (TRS) calculations.

6632 Radioactivity and Electromagnetic Transitions (Excluding Fission)

Refer also to citation(s) 2010, 2436, 2437

2014 (ANL/CP–76905) **Settled and open questions in ^{8}Li.** Kurath, D. Argonne National Lab., IL (United States). [1991]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9103193–2: Stan Hanna Mossbauer spectroscopy workshop, Stanford, CA (United States), 15-16 Mar 1991). Order Number DE92040749. Source: OSTI; NTIS; INIS; GPO Dep.

The experimentally observed electromagnetic properties of ^{8}Li are compared to shell model values. A recent BE2 measurement strongly disagrees with the model. Means of reconciliation and pertinent measurements are discussed.

2015 (CONF-920721–11) **New mass differences and α-decay rates for Au and Pt isotopes.** Kassim, M.B. (Tennessee Univ., Knoxville, TN (United States)); Zhang, M.; Bingham, C.R.; Akovali, Y.A.; Toth, K.S.; Carter, H.K.; Kormicki, J. Oak Ridge National Lab., TN (United States). [1992]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400 ;FG05-87ER40330 ;FG05-87ER40361 ;AC05-76OR00033 ;FG05-88ER40407. From 6. international conference on nuclei far from stability and 9th international conference on atomic masses and fundamental constants; Bernkastel-Kues (Germany); 19-24 Jul 1992. Order Number DE92040866. Source: OSTI; NTIS; !NIS; GPO Dep.

The alpha decay of $^{181--186}$Au and $^{181--185}$Pt has been studied utilizing sources from an on-line isotope separator. The α decay of ^{185}Pt and ^{186}Au was observed for the first time and several new α groups were observed for the decay of $^{181--185}$Au. By simultaneous measurement of γ-rays and x-rays and use of known ec/β+ decay schemes, α-decay branching ratios and hindrance factors were deduced for each α transition. Several previously unknown low-lying γ-ray transitions were observed in the Ir daughters by means of α-γ coincidence measurements.

2016 (CONF-920721–13) **Lifetimes of the O_2^+ configuration in ^{186}Hg and ^{188}Hg.** Joshi, P.K. (Louisiana State Univ., Baton Rouge, LA (United States). Dept. of Physics); Zganjar, E.F.; Rupnik, D.; Robinson, S.J.; Mantica, P.F.; Carter, H.K.; Gill, R.L.; Walters, W.B. Oak Ridge National Lab., TN (United States). [1992]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400 ;FG05-88ER40418 ;FG05-84ER40159 ;AS05-76ER03346 ;FG05-87ER40361 ;AC05-76OR00033 ;AC02-76CH00016 ;FG From 6. international conference on nuclei far from stability and 9th international conference on atomic masses and fundamental constants; Bernkastel-Kues (Germany); 19-24 Jul 1992. Order Number DE93001646. Source: OSTI; NTIS; INIS; GPO Dep.

A new picosecond lifetime measurement system developed at UNISOR was used to determine the lifetime of the well-deformed 0_2^+ levels in ^{188}Hg and ^{186}Hg. The half-life values were measured to be 288 $\pm$ 63 ps in ^{188}Hg and $\leq$ 52 ps in ^{186}HG. The corresponding values of $p^2(E0) \times 10^3$ obtained from the E0 partial half-lives are $5.5_{-2.3}^{+1.5}$ and $\geq$ 32, respectively. Additionally, the half-lives of the 2_2^+ levels were determined to be 199 $\pm$ 44 ps in ^{188}Hg and 66 $\pm$ 37 ps in ^{186}Hg.

2017 (INIS-mf–13358, pp. 114) **The 'mystery' of the K=I=25 isomers in $_{182}$Os.** Broude, C. (Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Physics); Hass, M.; Goldring, G.; Alderson, I.; Ali, I.; Cullen, D.M.; Fallon, P. Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Physics. 1992. 169p. (CONF-9204195–: 1992 Israel Physical Society annual meeting, Rehovot (Israel), 15 Apr 1992). In *Israel physical society 1992 annual meeting: Program and abstracts.* Order Number DE93604079. Source: OSTI; NTIS (US Sales Only); INIS.

Abstract only. OSMIUM 182/quadrupole moments

2018 (INT–245/PS) **Coulomb deexcitation of muonic hydrogen.** Czaplinski, W. (Institute of Physics and Nuclear Techniques, Cracow (Poland)); Gula, A.; Kravtsov, A.; Mikhajlov, A.; Popov, N.; Ovchinnikov, S. Institute of Physics and Nuclear Techniques, Cracow (Poland). 1990. 17p. Order Number DE93604474. Source: OSTI; NTIS (US Sales Only); INIS.

The cross sections and rates of Coulomb deexcitation of muonic hydrogen are calculated with electron screening taken into account. Results without electron screening are also calculated for comparison. It is shown that for high excited states of muonic hydrogen Coulomb deexcitation plays an important role and should be taken into account together with other deexcitation processes. (author).

2019 (IPNO-T–91-04) **Half-life and delayed neutron emission probabilities measurement of ^{44}S,$^{45-47}$Cl spectrometer: their implication in the ^{48}Ca/^{46}Ca ratio understanding in the solar system.** Sorlin, O. Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire; Paris-7 Univ., 75 (France). Jun 1991. 104p.

(In French). Order Number DE93721031. Source: OSTI; NTIS (US Sales Only); INIS.

After a detailed description of the simulation program LISE, experimental measurements of the radioactive decay (half-lives and neutron delayed emission probabilities) of the neutron rich nuclei ^{44}S, ^{45}Cl, ^{47}Cl are presented. The comparison between these results and the theoretical predictions clearly shows that mass and deformation measurements of these nuclei are very important to determine precisely the radioactive decay parameters necessary to astrophysics. Effectively, these ones are used in star evolution models to understand the elements abundance curve of the solar system. Even if the shape of this curve is well reproduced, some anomalies subsist. The experimental results seem to show that, with the constraints they bring, a double r process in low-mass supernovae of type II can explain twice the isotopic anomalies and the shape of the elements abundance curve.

2020 (IPNO-T–91-06) **Band structure in Platinum nuclei (A ≈ 182).** Popescu, D.G. Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire. 3 Dec 1991. 173p. (In French). Order Number DE93721701. Source: OSTI; NTIS (US Sales Only); INIS.

In this thesis, the author studies the band structure in Platinum nuclei and has divided his work in 5 parts: in the first, the author makes a general presentation of nucleus physics with a high angular momentum and introduces to the deformed nucleus notion -axial, triaxial or mixing of different deformations. The notion of form co-existence will be used to interpret the experimental results. In the second part, the author describes the detection means which have been used to make measurements. An abstract of theoretical notions, usefull for the understanding of fusion-evaporation reaction is presented. The author explains the details, performances and different modes of using of 'Chateau de cristal' and others used spectrometers. In the third part, the author presents all experimental data. He has effected γ coincidence measurements for Pt, Au and Ir nuclei. In the fourth part, for a classical analysis or an interpretation in the frame of cranking model the author presents theoretical models which are adapted at the study of high spin states and band structures.

2021 (JINR-E–3-91-428) **Intense two-step cascades of ^{158}Cd compound-state decay.** Ali, M.A. (and others); Bogdzel, A.A.; Khitrov, V.A. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Neutron Physics. 1991. 22p. Order Number DE93606156. Source: OSTI; NTIS (US Sales Only); INIS.

Photon spectra from thermal neutron capture in natural gadolinium were measured using the technique of amplitude summation of coinciding pulses to study ^{158}Gd compound-state decay and reveal its main peculiarities. The experimental cascade intensity distribution is campared with density dependence on the excitation energy. 19 refs.; 4 figs.; 3 tabs.

2022 (SINS–2106/A, pp. 32-40) **Beta-decay half-lives of very neutron rich Ni, Co, Fe isotopes produced by thermal fission of ^{235}U and ^{239}Pu.** Bernas, M. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire); Czajkowski, S.; Sida, J.L.; Armbruster, P.; Faust, H.; Bocquet, J.P.; Brissot, R. Institute of Atomic Energy, Otwock-Swierk (Poland). Nov 1990. (CONF-900857–: 21. Mikolajki summer school on nuclear physics: nuclear and atomic physics with accelerators of the nineties, Mikolajki (Poland), 26 Aug - 5 sep 1990). In *Nuclear and atomic physics with the accelerators of the nineties: Proceedings of the 21st Mikolajki summer school on nuclear physics, held in Mikolajki, Poland, August 26 - September 5, 1990. Seminars.* 111p. Order Number DE93604421. Source: OSTI; NTIS (US Sales Only); INIS.

A novel method of determination of β^- half-lives was extended to the new isotopes of ^{71}Ni, ^{72}Ni, ^{73}Ni, ^{74}Ni, ^{69}Co, ^{68}Co and ^{68}Fe. The obtained results are presented. (A.S.).

6633 Nuclear Reactions and Scattering, General

Refer also to citation(s) 1996, 2001, 2053, 2433

2023 (INIS-BR–2934, pp. 302-305) **Increase of elastic and inelastic cross sections of pp and p-bar p reactions at high energies and geometrical formalism.** Escobar, B.M.P. (Instituto de Fisica Teorica (IFT), Sao Paulo, SP (Brazil)); Menon, M.J. Sociedade Brasileira de Fisica, Rio de Janeiro, RJ (Brazil). 1989. 350p. (In Portuguese). (CONF-8909489–: 10. National Meeting on Physics of Particles and Fields, Itatiaia (Brazil), 20-24 Sep 1989). In *Proceedings of the 10. National Meeting on Physics of Particles and Fields.* Order Number DE93604123. Source: OSTI; NTIS (US Sales Only); INIS.

An analysis of energy and impact parameter dependence of elastic and inelastic recover functions for : pp reactions in the 23-62 GeV energy range and; p p-bar reactions in the 31-630 GeV energy range, using geometrical formalism is done. (M.C.K.).

2024 (INIS-mf–13358, pp. 118) **Investigations of parity violation in neutron resonances.** Grof, Y. (Ben-Gurion Univ. of the Negev, Beersheba (Israel)); Orion, I.; Mordechai, S. Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Physics. 1992. 169p. (CONF-9204195–: 1992 Israel Physical Society annual meeting, Rehovot (Israel), 15 Apr 1992). In *Israel physical society 1992 annual meeting: Program and abstracts.* Order Number DE93604079. Source: OSTI; NTIS (US Sales Only); INIS.

Abstract only. PIONS/double resonance methods; CHARGE EXCHANGE; PIONS

2025 (INIS-mf–13358, pp. 117) **Investigations of parity violation in neutron resonances.** Biryukov, S.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (Russian Federation). Inst. Atomnoj Ehnergii); Blaustein, J.; Mostovoy, V.I.; Muradyan, G.V. Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Physics. 1992. 169p. (CONF-9204195–: 1992 Israel Physical Society annual meeting, Rehovot (Israel), 15 Apr 1992). In *Israel physical society 1992 annual meeting: Program and abstracts.* Order Number DE93604079. Source: OSTI; NTIS (US Sales Only); INIS.

Abstract only. NEUTRON REACTIONS/resonance; RESONANCE; PARITY

2026 (SINS–2106/A, pp. 15-19) **Analyzing power of the ^{34}S(p, t)^{32}S reaction at 30 and 40 MeV.** Sieminski, M. (Warsaw Univ. (Poland)); Saganek, A.; Wesolowski, E.; Wilhelmi, Z.; Takami, S.; Hatori, K.; Hasegawa, T.; Yasue, M.; Nakagawa, T.; Takamatsu, J. Institute of Atomic Energy, Otwock-Swierk (Poland). Nov 1990. (CONF-900857–: 21. Mikolajki summer school on nuclear physics: nuclear and atomic physics with accelerators of the nineties, Mikolajki (Poland), 26 Aug - 5 sep 1990). In *Nuclear and atomic physics with the accelerators of the nineties: Proceedings of the 21st Mikolajki summer school on nuclear physics, held in Mikolajki, Poland, August 26 - September 5, 1990. Seminars.* 111p. Order Number DE93604421. Source: OSTI; NTIS (US Sales Only); INIS.

The analyzing power angular distributions for the $^{34}S(p,t)^{32}S(gs,0^+)$ reaction, measured at 30 and 40 MeV of protons, are compared with predictions of the finite-range DWBA model. The experimental results can be reproduced correctly, without including the sequential transfer process. (author).

2027 (SINS–2106/A, pp. 20-25) **Multipole decomposition of doubly differential cross sections - a model independent analysis.** Osuch, S. (Warsaw Univ. (Poland). Inst. Fizyki Doswiadczalnej); Szeflinska, G.; Szeflinski, Z.; Wilhelmi, Z. Institute of Atomic Energy, Otwock-Swierk (Poland). Nov 1990. (CONF-900857–: 21. Mikolajki summer school on nuclear physics: nuclear and atomic physics with accelerators of the nineties, Mikolajki (Poland), 26 Aug - 5 sep 1990). In *Nuclear and atomic physics with the accelerators of the nineties: Proceedings of the 21st Mikolajki summer school on nuclear physics, held in Mikolajki, Poland, August 26 - September 5, 1990. Seminars.* 111p. Order Number DE93604421. Source: OSTI; NTIS (US Sales Only); INIS.

We propose a new, model independent method which can be used to analyse high quality data from inelastic scattering or charge exchange reactions. Such data contain resonances observed as bumps superimposed on a smooth continuum generally assumed to the background. The major problem in these studies is the decomposition of data into bumps originating from nuclear excitations and the underlying continuum. (author).

6634 Specific Nuclear Reactions and Scattering

Refer also to citation(s) 306, 1006, 1956, 1991, 2002, 2004, 2018, 2026, 2056, 2439, 2445

2028 (DOE/ER/40269–14) **Nuclear Physics Laboratory technical progress report, [August 15, 1991–October 1, 1992].** Colorado Univ., Boulder, CO (United States). Nuclear Physics Lab. 1 Oct 1992. 122p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-86ER40269 ;FG02-87ER40335. Order Number DE93001614. Source: OSTI; NTIS; INIS; GPO Dep.

This report summarizes work carried out between August 15, 1991 and October 1, 1992 at the Nuclear Physics Laboratory of the University of Colorado, Boulder, under contracts DE-FG02-86ER-40269 and DE-FG02-87ER-40335 with the United States Department of Energy. These contracts support experimental and theoretical work in intermediate energy nuclear physics. The experimental program is very broadly based; it includes pion-nucleon and pion-nucleus studies at Los Alamos and TRIUMF inelastic pion scattering and charge exchange reactions at LAMPF, kaon-nucleus scattering at the AGS, and nucleon charge exchange at LAMPF/NTOF.

2029 (DOE/ER/40316–6) **Studies of complex fragment emission in heavy ion reactions: Progress report, January 1, 1990–August 5, 1992.** Charity, R.J.; Sobotka, L.G. Washington Univ., St. Louis, MO (United States). 1992. 60p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-87ER40316. Order Number DE92040847. Source: OSTI; NTIS; INIS; GPO Dep.

Our work involves the study of intermediate energy heavy-ion nuclear reactions. This work has two foci. On the one hand, we desire to learn about the properties of nuclear matter under abnormal conditions, in this energy domain, predominately low densities. This purpose runs abreast of the second, which is the study of the relevant reaction mechanisms. The two objectives are inexorably linked because our experimental laboratory for studying nuclear matter properties is a dynamic one. We are forced to ask how nuclear matter properties, such as phase transitions, are reflected in the dynamics of the reactions. It may be that irrefutable information about nuclear matter will not be extracted from the reaction work. Nevertheless, we are compelled to undertake this effort not only because it is the only game in town and as yet we do not know that information cannot be extracted, but also because of our second objective. The process leads to an understanding of the reaction mechanism themselves and therefore to the response characteristics of finite, perhaps non-equilibrium, strongly interacting systems. Our program has been: To study energy, mass, and angular momentum deposition by studying incomplete fusion reactions. To gain confidence that we understand how highly excited systems decompose by studying all emissions from the highly excited systems. To push these kinds of studies into the intermediate energy domain, with excitation function studies. And attempt to learn about the dynamics of the decays using particle-particle correlations. In the last effort, we have decided to focus on simple systems, where we believe, definitive statements are possible. These avenues of research share a common theme, large complex fragment production.

2030 (DOE/ER/40408–7) **Deexcitation processes in nuclear reactions: Annual progress report.** Porile, N.T. Purdue Univ., Lafayette, IN (United States). Dept. of Chemistry. Sep 1992. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-88ER40408. Order Number DE93000400. Source: OSTI; NTIS; INIS; GPO Dep.

During the past year, our research program has involved continuing analysis of Fermilab E-735, search for quark-gluon plasma (QGP) in $\bar{p}$-p collisions; continuing study of target fragments produced in the interaction of copper with intermediate-energy heavy ions; an exclusive study of multifragmentation using reverse kinematics at the Bevalac; and detector development for the STAR detector at RHIC.

2031 (DOE/ER/40571–T1) **Investigation of rare particle production in high energy nuclear collisions: Progress report.** California Univ., Berkeley, CA (United States). 5 Oct 1992. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG03-90ER40571. Order Number DE93003269. Source: OSTI; NTIS; INIS; GPO Dep.

Short communication. HEAVY ION REACTIONS/particle production; PROGRESS REPORT; BROOKHAVEN AGS; DEUTERIUM; NUCLEAR MATTER; QUARK MATTER

2032 (GANIL-A–92-02) **Charge exchange of very heavy ions in carbon foils and in the residual gas of the Ganil cyclotrons.** Baron, E.; Bajard, M.; Ricaud, C. Grand Accelerateur National d'Ions Lourds (GANIL), 14 - Caen (France). 1992. 5p. (CONF-9206299–: 6. Conference on Electrostatic Accelerators and Associated Boosters, Padova (Italy), 1-5 Jun 1992). Order Number DE93721017. Source: OSTI; NTIS (US Sales Only); INIS.

The results of several years of operation with heavy to very heavy ions in the GANIL accelerators, along with specific measurements concerning stripping through carbon foils, led to a set of valuable recipes for predicting the characteristics required to obtain a desired charge state distribution. The ion species under study range from Ar to U and the energies from 3.8 to 10.6 MeV/nucleon. The experimental method and the fits of the results are presented. A series of measurements was also set up to evaluate the beam losses during acceleration in the three cyclotrons; with the help of existing models for charge exchange cross-sections, it is shown that vacuum requirements can be fairly accurately determined. 7 tabs.

2033 (IC–92/151) **Theory of deep-inelastic scattering reactions and x-rescaling model.** Kaptari, L.P. (International Centre for Theoretical Physics, Trieste (Italy)); Umnikov, A.Yu. International Centre for Theoretical Physics, Trieste (Italy). Jul 1992. 21p. Order Number DE93604519. Source: OSTI; NTIS (US Sales Only); INIS.

A novel point of view on the x-rescaling model in leptons-nucleus deep inelastic scattering is suggested. Using the operator product expansion method within the effective meson-nucleon theory, we present a rigorous consideration of the scattering on the deuteron. We demonstrate that with the contributions interpreted as the Fermi motion and mesonic corrections, the x-rescaling idea is exactly reproduced. The diagrams of the scattering off bound nucleons have also been computed numerically. It is shown that taking into account the nuclear effects viz. shadowing and meson exchange currents the experimental behavior of the ratio of deuteron and nucleon structure functions as $x \rightarrow 0$ is explained. The Gottfried integral is estimated as well. (author). 26 refs, 5 figs.

2034 (INIS-BR–2942, pp. 47) **Presentation of an experimental technique for measurement of the parameter P using uranium thin target made at CNEN/IEN Laboratories.** Souza, M.I.S. (Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Div. de Fisica de Reatores). Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1989. 147p. (In Portuguese). In *Triennial technical report - 1986, 1987, 1988 - Instituto de Engenharia Nuclear (IEN) -Dept. of Reactors (DERE).* Order Number DE93605069. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. NEUTRON REACTIONS/capture; NEUTRON REACTIONS/uranium 238 target; CADMIUM; FISSION PRODUCTS; NEPTUNIUM 239; CAPTURE; THIN FILMS; URANIUM 239

2035 (INIS-BR–2942, pp. 46-47) **Presentation of a technique for measure of fast fission reactor.** Furieri, R.C.A.A. (Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Div. de Fisica de Reatores). Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1989. 147p. (In Portuguese). In *Triennial technical report - 1986, 1987, 1988 - Instituto de Engenharia Nuclear (IEN) -Dept. of Reactors (DERE).* Order Number DE93605069. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. FAST FISSION/uranium 235; FAST FISSION/uranium 238; ELECTRODEPOSITION; ENRICHED URANIUM; MEASURING METHODS; NEUTRONS; NUCLEAR FUELS; THIN FILMS

2036 (INIS-mf–13349, pp. 8-9) **Measuring parity nonconservation in elastic scattering of polarized electrons from carbon 12 nuclei.** Farkhondeh, M. (Massachusetts Inst. of Tech.,

Middel Town, MA (USA). Center of Linear Accelarator, Bates). Iranian Physics Society, Teheran (Iran, Islamic Republic of). 1991. 53p. (In Persian). (CONF-9109417--: Iran's physics conference, Isfahan (Iran, Islamic Republic of), 10 Sep 1991). In *Abstract of articles from Iran's physics conference*. Order Number DE93000811. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. P INVARIANCE/elastic scattering; ASYMMETRY; CARBON 12 TARGET; ELECTROMAGNETIC INTERACTIONS; ELECTRON BEAMS; POLARIZED BEAMS; WEAK INTERACTIONS

2037 (INIS-mf-13349, pp. 12) **The latest discoveries on 103Ag.** Rastikerdar, S. (Isfahan Univ., (Iran). Physics Group). Iranian Physics Society, Teheran (Iran, Islamic Republic of). 1991. 53p. (In Persian). (CONF-9109417--: Iran's physics conference, Isfahan (Iran, Islamic Republic of), 10 Sep 1991). In *Abstract of articles from Iran's physics conference*. Order Number DE93000811. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. SILVER 103/gamma detection; HEAVY ION REACTIONS; IRON 56 TARGET; PROTONS; SPECTRA

2038 (INIS-mf-13358, pp. 120) **The evidence for production of the superheavy element with Z=112 via secondary and direct heavy-ions reactions.** Marinov, A. (Hebrew Univ., Jerusalem (Israel). Racah Inst. of Physics). Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Physics. 1992. 169p. (CONF-9204195--: 1992 Israel Physical Society annual meeting, Rehovot (Israel), 15 Apr 1992). In *Israel physical society 1992 annual meeting: Program and abstracts*. Order Number DE93604079. Source: OSTI; NTIS (US Sales Only); INIS.

Abstract only. ELEMENT 112/nucleosynthesis; NUCLEOSYNTHESIS; HEAVY ION FUSION REACTIONS

2039 (ISN-92-31) **Study of evolution of $^{40}Ar+^{nat}Ag$ reaction from 7 to 34 MeV/u with a 4π multidetector of charged particles.** Ethvignot, T. Grenoble-1 Univ., 38 (France). Inst. des Sciences Nucleaires. Mar 1992. 132p. (In French). Order Number DE93721025. Source: OSTI; NTIS (US Sales Only); INIS.

Properties of hot nuclei have been studied in the reactions of ^{40}Ar with ^{nat}Ag at 7, 17, 27 and 34 MeV with AMPHORA, a 4π multidetector for charged particles. For central collisions, the results support the classical picture of hot (E* as great as 5 MeV/Nucleon), heavy (M $\approx$ 100-130 amu) nuclear systems, with high spin ($J_{max} \geq 100h/2\pi$) that emit a long chain of particles and fragments. Out-of-plane fragment production increases strongly with incident energy. This suggests that symmetric fission gradually disappears, as three or more body breakup processes become preferred modes of decay. Furthermore, the fragment-fragment correlations seem to indicate that Li fragments are emitted rapidly ($\tau \leq 10^{-21}$s) and often before the protons and α particles. This implies that thermalization of the composite nucleus is so fast that it clouds a clear signal for the hypothesis of 'instantaneous' multifragmentation.

2040 (JINR-E-1-91-511) **The study of reactions with deuteron and pions in the final state by np- and dp-interactions comparison.** Glagolev, V.V. (and others); Troyan, Yu.A.; Lebedev, R.M. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of High Energy. 1991. 24p. Order Number DE93606160. Source: OSTI; NTIS (US Sales Only); INIS.

Characteristics of dp-$d\pi^+$n, dp->$dp\pi^+\pi^-$ and np->$d\pi^+\pi^-$ reactions at 1.7 GeV/c/nucleon obtained by working up the films from 1-m hydrogen bubble chamber JINR were studied. By the comparison of dp- and np-interactions the coherent production of π on deuteron and baryon exchange processes were separated in deuteron reactions. 18 refs.; 12 figs.; 2 tabs.

2041 (JINR-E-4-91-336) **Off-shell form factors in the soft photon limit for pion photoproduction.** Chumbalov, A.A. (AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki); Kamalov, S.S. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Theoretical Physics. 1991. 4p. Order Number DE93606161. Source: OSTI; NTIS (US Sales Only); INIS.

Submitted to Phys. Lett., B.

The low energy theorems for the pion photoproduction are considered on the basis of the Adler-Dothan procedure. It is shown that the soft photon limit necessarily leads to the Born approximation for the π^0-photoproduction amplitude at the threshold. All additional terms, according to the Adler-Dothan recipe, are to be neglected in the derivation of the LET. 5 refs.; 2 figs.

2042 (JINR-E-15-91-411) **Studies of formation of fusion evaporation residues with Z$\geq$83 in heavy ion reactions.** Andreev, A.N. (and others); Bogdanov, D.D.; Chepigin, V.I. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Reactions. 1991. 14p. Order Number DE93606172. Source: OSTI; NTIS (US Sales Only); INIS.

Submitted to Intern. Symposium Nikko 91, 'Toward a Unified Picture of Nuclear Dynamics', Japan, 6-8 June, 1991.

By employing the kinematic separator VASSILISSA and the beams of $^{20,22}Ne$, $^{24,26}Mg$, ^{40}Ar and ^{40}Ca 18 projectile-target combinations leading to formation of compound nuclei with atomic numbers 83-102 and obtained xn, pxn and axn evaporation residues in the range of the projectile energy extending from the Coulomb barrier to the values corresponding to the compound nucleus excitation of about 100 MeV are studied. The systematics is presented of the maximum xn reaction cross-sections which are governed by the fissility of the reaction products. As a result, the values of macroscopic fission barriers were extracted for the neutron-deficient nuclides in the range of Z=83-92 and N=104-134. 43 refs.; 9 figs.; 5 tabs.

2043 (JINR-R-1-90-584) **Total breakup of ^{3}He and ^{4}He nuclei in interactions with protons.** Glagolev, V.V. (Joint Inst. for Nuclear Research, Dubna (Russian Federation)); Lebedev, R.M.; Pestova, G.D. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of High Energy. 1990. 11p. (In Russian). Order Number DE93606171. Source: OSTI; NTIS (US Sales Only); INIS.

The experiment has been performed on the JINR synchrotron by means of the 100-cm liquid-hydrogen chamber. The total cross sections of the nonmesonic breakup reactions of ^{3}He and ^{4}He nuclei are determined. The analysis of the nuclear reaction is carried out. It is shown that the total nonmesonic ^{3}He nuclei breakup occurs mainly as a result of the proton quasi-elastic scattering on one of the nucleon of the nucleus, whereas the total nonmesonic ^{4}He-breakup - principally in the double proton scattering with the nucleons of the nucleus. 11 refs.; 6 figs.; 4 tabs.

2044 (JINR-R-1-91-85) **The production of two multicharged fragments in fragmentation of ^{28}Si on photoemulsion nuclei.** Vokal, S. (Joint Inst. for Nuclear Research, Dubna (Russian Federation)); Shabratova, G.S.; Avetyan, F.A. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1991. 6p. (In Russian). Order Number DE93606173. Source: OSTI; NTIS (US Sales Only); INIS.

Experimental data on ^{28}Si relativistic nuclei fragmentation in interactions with photoemulsion nuclei are given. The charge characteristics of fragments, their pair azimuthal angle distributions and momentum spectra in the events with two multicharged fragments have been obtained. The comparison with the percolation model has been performed. 7 refs.; 6 figs.; 2 tabs.

2045 (JINR-R-1-91-439) **The measurement of the differential cross section in the double quasi-elastic proton scattering on ^{12}C at the energy of (660+-7) MeV.** Budyashov, Yu.G.; Nadezhdin, V.S.; Petrov, N.I.; Satarov, V.I. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems. 1991. 4p. (In Russian). Order Number DE93606165. Source: OSTI; NTIS (US Sales Only); INIS.

The reaction of direct knock-out of proton pairs from ^{12}C nuclei at 660 MeV was investigated with a three-arm spark spectrometer in conditions when the main contribution to the reaction gives the mechanism of the double quasi-elastic scattering. The differential cross section of the reaction is measured. 5 refs.; 3 figs.

2046 (JINR-R-1-91-522) **About possibility of standing the production region dimensions of fast protons.** Kalinina, N.A. (Moskovskij Gosudarstvennyj Univ., Moscow (Russian Federation). Nauchno-Issledovatel'skij Inst. Yadernoj Fiziki); Lednitskij, R.; Khazins, D.M. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems. 1991. 10p. (In Russian).

Order Number DE93606166. Source: OSTI; NTIS (US Sales Only); INIS.

The correlation functions of fast proton pairs produced with small relative pulses are calculated. Measurements could be produced for protons with pulses to 2.5 GeV/c, that is twice as much that the received one by means of bubble chambers. 11 refs.; 5 figs.

2047 (JINR-R–6-91-430) **Spin-neutrino angular correlation in nuclear capture of polarized muons.** Egorov, V.G. (and others); Brudanin, V.B.; Vorobel, V. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems. 1991. 20p. (In Russian). Order Number DE93606164. Source: OSTI; NTIS (US Sales Only); INIS.

The experimental method of angular correlation measurement in nuclear capture muons is described. The results of two test experiments with a silicon target are presented. 23 refs.; 15 figs.; 1 tab.

2048 (LPCC-T–92-01) **Hot nuclei production in Ar+Ag reactions at 50 and 70 MeV/u: limits of decay standard mode.** Vient, E. Caen Univ., 14 (France). Lab. de Physique Corpusculaire. Apr 1992. 115p. (In French). Order Number DE93721016. Source: OSTI; NTIS (US Sales Only); INIS.

The experiment discussed in this thesis is devoted to the study of hot nuclei produced in the Ar + Ag collisions at 50 and 70 MeV per nucleon. Special emphasis has been given to the standard decay of these nuclei, i.e. to the sequential evaporation process leading to a heavy residue. The experimental set up has been triggered by a residue detector and all the evaporated light charged particles have been detected in a large area set up covering nearly the whole space. It has been possible to sort all the detected particles and to isolate those evaporated from the initial hot nuclei, the initial characteristics of which have been reconstructed. Two important features have been stressed: - A shot nuclei can sustain an excitation energy of 6 MeV/a and a temperature of 8 MeV without disintegrating completely. - The distributions of excitation energy stored at 50 and 70 MeV/nucleon are similar. This result can refled either an entrance channel property or a hot nuclei behaviour. Further results obtained in this work give arguments supporting the first interpretation.

2049 (LU-TP–92-12) **Diffractive J/Ψ-electroproduction in LLA QCD.** Ryskin, M.G. (Lund Univ. (Sweden). Dept. of Theoretical Physics and St. Petersbourg Nuclear Physics Inst. (Russian Federation)). Lund Univ. (Sweden). Dept. of Theoretical Physics. Mar 1992. 7p. Order Number DE93604504. Source: OSTI; NTIS; INIS.

Cross section of diffractive J/Ψ-production in deep inelastic scattering in the Born and the leading log approximations of perturbative QCD are calculated. (au).

2050 (PCCF-T–91-02) **Inclusive experimental study of dimuon production in proton-nucleus interactions at 450 GeV/c.** Fredj, L. Clermont-Ferrand-2 Univ., 63 - Aubiere (France). Lab. de Physique Corpusculaire. Sep 1991. 171p. (In French). Order Number DE93721005. Source: OSTI; NTIS (US Sales Only); INIS.

The relative J/Ψ and Ψ suppression and Φ enhancement observed in the NA38 experiment may be explained by the formation of the quarks and gluons plasma and/or more classical phenomena. In the NA38 framework we study the production of dimuons using a direct proton beam at 450 GeV/c and a set of 4 targets (C, Al, Cu and W). For this work the apparatus has been modified in order to reduce the background and improve the mass resolution. Rigorous error propagation as well as the good statistics did allow us to retain the power law ($\sigma/A = A^{\alpha-1}$) of the production's parametrisation which is good agreement with our data instead of the linear law ($\sigma/A = k - k'A$). All the mass range between 0.5 and 5 GeV/c^2 has been explored, we give the α parameter of all processes in this range and the production ratio of a process X relatively to an other process Y where X is always sensitive to the Quagma formation, these ratios has been calculated in three different ways, all results are very coherent. Our results compatible with those published are more precise. We give also the partial cross sections and the experimental perspectives. 58 tabs., 61 figs.

2051 (PCCF-T–92-02) **Differential cross section study of fragment production, at small angle, in relativistic heavy ion collisions. Application at a calculation of heavy ion beam transport in the matter.** Morel, P. Clermont-Ferrand-2 Univ., 63 - Aubiere (France). Lab. de Physique Corpusculaire. Feb 1992. 183p. (In French). Order Number DE93721007. Source: OSTI; NTIS (US Sales Only); INIS.

Relativistic heavy ion collisions present the opportunity of creating in laboratory small volumes of hot, dense nuclear matter. On the experimental point of view, the collision events are characterized by a great number of fragments, especially in the direction of the projectile. The first part is devoted to a survey of relativistic heavy ion physics. Then, we present two experimental set-ups which permit, in particular, the analyse of light fragment production at small angles. We present experimental results concerning light projectiles on Ca, Nb, Pb targets, with energies from 200 A.MeV up to 600 A.MeV. Different aspects of the collision are put in evidence. Momentum and charge differential cross section are extrapolated to other projectile/target systems; that is used in a transport calculation of Ne ions in a target of biological interest (water), with a collimator. We show that nuclear fragmentation produces a dispersion in the spatial and energy distributions, and that one light fragments have a range greater than the projectile range. That last point causes a distortion of the Bragg curve, and that distortion must be taken into account for the application of heavy ions to radiotherapy problems. 95 figs., 8 tabs.

2052 (SINS–2106/A, pp. 12-14) **Competition between pn and d emission in α + ^{51}V, ^{54}Fe reactions at 26.5 MeV.** Bednarczyk, P. (Institute of Nuclear Physics, Cracow (Poland)); Bozek, E.; Fornal, B.; Lach, M.; Maj, A.; Meczynski, W.; Pawlat, T.; Styczen, J. Institute of Atomic Energy, Otwock-Swierk (Poland). Nov 1990. (CONF-900857–: 21. Mikolajki summer school on nuclear physics: nuclear and atomic physics with accelerators of the nineties, Mikolajki (Poland), 26 Aug - 5 sep 1990). In *Nuclear and atomic physics with the accelerators of the nineties: Proceedings of the 21st Mikolajki summer school on nuclear physics, held in Mikolajki, Poland, August 26 - September 5, 1990. Seminars.* 111p. Order Number DE93604421. Source: OSTI; NTIS (US Sales Only); INIS.

The competition between pn and d evaporated from compound nuclei created the fusion of 26.5 MeV α-particles on ^{51}V and ^{54}Fe was studied. The nuclear level density parameter a=A/9.3 for excited nuclei populated in these reactions was extracted. (author).

2053 (SINS–2106/A, pp. 1-6) **On correlations between fragment mass and excitation energy division in the ^{74}Ge + ^{165}Ho reaction.** Planeta, R. (Uniwersytet Jagiellonski, Cracow (Poland). Inst. Fizyki); Toke, J.; Schroeder, W.U.; Huizenga, J.R. Institute of Atomic Energy, Otwock-Swierk (Poland). Nov 1990. (CONF-900857–: 21. Mikolajki summer school on nuclear physics: nuclear and atomic physics with accelerators of the nineties, Mikolajki (Poland), 26 Aug - 5 sep 1990). In *Nuclear and atomic physics with the accelerators of the nineties: Proceedings of the 21st Mikolajki summer school on nuclear physics, held in Mikolajki, Poland, August 26 - September 5, 1990. Seminars.* 111p. Order Number DE93604421. Source: OSTI; NTIS (US Sales Only); INIS.

Results of alternative analysis of experimental data for ^{74}Ge + ^{165}Ho reaction are presented. Information about the correlation between the excitation energy division and net nucleon transfer is extracted. (author).

2054 (SINS–2106/A, pp. 63-67) **The dependence of delta electrons accompanying deep inelastic and transfer reactions on nuclear contact times.** Hoszowska, J. (Soltan Inst. for Nuclear Studies, Otwock-Swierk (Poland)); Ludziejewski, T.; Sujkowski, Z. Institute of Atomic Energy, Otwock-Swierk (Poland). Nov 1990. (CONF-900857–: 21. Mikolajki summer school on nuclear physics: nuclear and atomic physics with accelerators of the nineties, Mikolajki (Poland), 26 Aug - 5 sep 1990). In *Nuclear and atomic physics with the accelerators of the nineties: Proceedings of the 21st Mikolajki summer school on nuclear physics, held in Mikolajki, Poland, August 26 - September 5, 1990. Seminars.* 111p. Order Number DE93604421. Source: OSTI; NTIS (US Sales Only); INIS.

Discussion of the applicability of δ-electron spectroscopy to the study of the time evolution of heavy ion collisions at intermediate bombarding energies is presented. The dependence of delta electron spectra on nuclear contact time is analysed for Xe+Sn, Xe+Pb and U+U reactions at 20 MeV/u and 40 MeV/u beam energies. (author).

2055 (SINS–2106/A, pp. 26-27) **Nuclear charge distribution in symmetric and asymmetric fission induced by light charged particles.** Jauho, P.P. (Jyvaeskylae Univ. (Finland). Dept. of Physics). Institute of Atomic Energy, Otwock-Swierk (Poland). Nov 1990. (CONF-900857–: 21. Mikolajki summer school on nuclear physics: nuclear and atomic physics with accelerators of the nineties, Mikolajki (Poland), 26 Aug - 5 sep 1990). In *Nuclear and atomic physics with the accelerators of the nineties: Proceedings of the 21st Mikolajki summer school on nuclear physics, held in Mikolajki, Poland, August 26 - September 5, 1990. Seminars.* 111p. Order Number DE93604421. Source: OSTI; NTIS (US Sales Only); INIS.

I have studied the charge dispersion by determining the yields of elements in isobaric mass chains at A=80, 82, 84, 110, 112, 114, 116, 118, 120 using proton and deuteron induced fission of ^{238}U. (author).

6635 Nuclear Mass Ranges

Refer also to citation(s) 306, 1991, 1999, 2006, 2015, 2020, 2021, 2022, 2030, 2036, 2039, 2040, 2043, 2044, 2046, 2048

6636 Radiation Physics

Refer also to citation(s) 1467, 1468, 2428, 2438, 2446

2056 (AECL–10056) **Analytic scattering kernels for neutron thermalization studies.** Sears, V.F. Atomic Energy of Canada Ltd., Chalk River, ON (Canada). Chalk River Nuclear Labs. Jan 1990. 40p. Order Number DE93604590. Source: OSTI; NTIS (US Sales Only); INIS.

Current plans call for the inclusion of a liquid hydrogen or deuterium cold source in the NRU replacement vessel. This report is part of an ongoing study of neutron thermalization in such a cold source. Here, we develop a simple analytical model for the scattering kernel of monatomic and diatomic liquids. We also present the results of extensive numerical calculations based on this model for liquid hydrogen, liquid deuterium, and mixtures of the two. These calculations demonstrate the dependence of the scattering kernel on the incident and scattered-neutron energies, the behavior near rotational thresholds, the dependence on the centre-of-mass pair correlations, the dependence on the ortho concentration, and the dependence on the deuterium concentration in H_2/D_2 mixtures. The total scattering cross sections are also calculated and compared with available experimental results.

2057 (FEI–2080) **Invariance of solution of transport equations in closed subregion on surface sources of specific class.** Korobejnikov, V.V.; Usanov, V.I. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk (Russian Federation). Fiziko-Ehnergeticheskij Inst. 1990. 19p. (In Russian). Order Number DE93606179. Source: OSTI; NTIS (US Sales Only); INIS.

Invariance of solution of heterogeneous transport equation inside a closed subregion using a surface source set on its boundary with arbitrary change in the subregion properties was proved. Beyond the subregion solution equals the difference of the initial and subsidiary problems. The theorem proved is illustrated by numerical and analytical examples. The field of its application is heterogeneous regions of protection and subcritical systems with sources. 7 refs.; 2 figs.; 2 tabs.

2058 (IAEA-R–5470-F) **Experimental measurements of total attenuation cross section and photoelectric cross section for Fe, Cu, Sn, Y, SiH_4 and Si in the X-ray energy range of 1,4 KeV - 29 KeV: Final report for the period 15 December 1988 - 14 May 1992.** Wang Dachun (Beijing Normal Univ., Beijing (China). Beijing Radiation Center). International Atomic Energy Agency, Vienna (Austria). Sep 1992. 29p. Order Number DE93606183. Source: OSTI; NTIS (US Sales Only); INIS.

With x-rays produced by photon exciting elemental and compounds targets, the mass attenuation coefficients have been systematically measured for Cu, Fe, Sn, Y, SiH_4 and Si in the x-ray energy range of 1.4 KeV to 29 KeV. The photoelectric cross sections have been obtained by subtracting thermal diffuse scattering and Compton scattering cross section from the measured total cross sections and compared with the theoretical results. Refs and tabs.

2059 (INIS-BR–2933, pp. 271) **Method to align and/or measure surface inclination using the phenomenum of conical diffraction.** Hogert, E.N. (Comision Nacional de Energia Atomica, Buenos Aires (Argentina). Grupo de Otica); Rebollo, M.A.; Gaggioli, N.G. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Spanish). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. SURFACES/alignment; SURFACES/diffraction; DIFFRACTION GRATINGS; SURFACES; ALIGNMENT; DIFFRACTION

2060 (INIS-BR–2933, pp. 270) **Auto-diffraction experience in alexandrite.** Cansian, A.M. (Sao Paulo Univ., Sao Carlos, SP (Brazil). Inst. de Fisica e Quimica); Catunda, T.; Castro, J.C. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. CRYSTALS/diffraction; CRYSTALS; DIFFRACTION; DIFFRACTION GRATINGS

2061 (INIS-BR–2942, pp. 13) **Cross sections calculation by inelastic neutron transmission and scattering.** Voi, D.L. (Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Div. de Fisica de Reatores). Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1989. 147p. (In Portuguese). (CONF-860343–: 1. general congress on nuclear energy, Rio de Janeiro (Brazil), 17-20 Mar 1986). In *Triennial technical report - 1986, 1987, 1988 - Instituto de Engenharia Nuclear (IEN) -Dept. of Reactors (DERE).* Order Number DE93605069. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. BAKELITE/neutron reactions; NEUTRON REACTIONS/inelastic scattering; BAKELITE; CROSS SECTIONS; NEUTRON SPECTROMETERS; RIEN-1 REACTOR

2062 (JINR-R–3-91-320) **Program SITHA. New version of the multigroup system of the neutron cross section GR175-V1.** Daniehl', A.V. (Radievyj Inst., Leningrad (Russian Federation)); Perov, V.Yu.; Sokol, E.A. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Reactions. 1991. 14p. (In Russian). Order Number DE93606180. Source: OSTI; NTIS (US Sales Only); INIS.

Structure of the system of the group neutron constants with band description of the resonance field and program system is described. Results of the testing calculations, made by code SITHA, for number of integral experiments devoted to measurements of the neutron flux from H_2O,C,N,O and Al spherical targets are discussed. 13 refs.; 8 figs.; 1 tab.

6640 Atomic and Molecular Physics

Refer also to citation(s) 1983, 1985

6641 Theory of Electronic Structure of Atoms and Molecules

Refer also to citation(s) 2163

2063 (IC–92/162) **Concentration fluctuations at the liquid-vapour coexistence in Ne-Ar mixture.** Osman, S.M. (International Centre for Theoretical Physics, Trieste (Italy)); Singh, R.N. International Centre for Theoretical Physics, Trieste (Italy). Jul 1992. 4p. Order Number DE93604600. Source: OSTI; NTIS (US Sales Only); INIS.

We present a new analytical formula for the concentration fluctuations, in the long-wavelength limits, $S_{cc}(0)$, for Lennard-Jones fluids based on the WCA theory and RPA approximation. This had

made possible to investigate the dependence of $S_{cc}(0)$ on concentration, pressure and temperature throughout the liquid and vapour phases, as well as across the liquid-vapour coexistence regions of the phase diagram of Ne-Ar mixture. (author). 11 refs, 3 figs.

2064 (INIS-BR–2933, pp. 243) **Self-consistent calculation in direct space of charge transfer distribution in a-Zr.** Frota-Pessoa, S. (Sao Paulo Univ., SP (Brazil). Inst. de Fisica); Methfessel, M.S. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. ZIRCONIUM/electronic structure; AMORPHOUS STATE; CHARGE DISTRIBUTION; CHARGE STATES; CRYSTAL MODELS; ZIRCONIUM

2065 (INIS-BR–2933, pp. 250) **$^{12}CD_3OH$ to $^{13}CD_3OH$ optical pumping by $^{13}CO_2$ laser: generation and identification of new IVL laser lines.** Pereira, D. (Universidade Estadual de Campinas, SP (Brazil). Inst. de Fisica); Scalabrin, A.; Galvao, G.P.; Evenson, K.M. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. DEUTERIUM COMPOUNDS/carbon dioxide lasers; CARBON 13; ENERGY LEVELS; HYDROXIDES; MOLECULES; OPTICAL PUMPING

2066 (INIS-BR–2933, pp. 251) **High resolution spectroscopy of $^{13}CD_3OH$: generation of new laser lines, frequency measurements and identification of new transitions.** Moraes, J.C.S. (Universidade Estadual de Campinas, SP (Brazil). Inst. de Fisica); Scalabrin, A.; Pereira, D.; Moretti, A.; Strumia, F. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. DEUTERIUM COMPOUNDS/carbon dioxide lasers; CARBON 13; ENERGY-LEVEL TRANSITIONS; FREQUENCY MEASUREMENT; HYDROXIDES; MOLECULES; OPTICAL PUMPING; SPECTROSCOPY

2067 (INIS-BR–2933, pp. 311) **Dynamics of simulated annealing linked to Hartree-Fock-Roothaan formalism.** Freitas, F.B. de (Sao Paulo Univ., SP (Brazil). Inst. de Fisica); Piquini, P.; Antonelli, A.; Fazzio, A. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. MOLECULAR MODELS/dynamics; ANNEALING; EQUATIONS OF MOTION; HARTREE-FOCK METHOD; LAGRANGIAN FUNCTION; DYNAMICS; POTENTIAL ENERGY

2068 (INIS-BR–2933, pp. 318) **Effect of correlation in binding energy of hydrogen impurities.** Borges, A.N. (Goias Univ., Goiania, GO (Brazil). Dept. de Fisica); Hipolito, O. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. SEMICONDUCTOR MATERIALS/binding energy; SEMICONDUCTOR MATERIALS/impurities; ANISOTROPY; CORRELATIONS; ELECTRON DENSITY; GERMANIUM; HYDROGEN; INTERACTION RANGE; POTENTIAL ENERGY; SELF-CONSISTENT FIELD; IMPURITIES; SILICON

2069 (INIS-BR–2933, pp. 370) **Study on indirect interaction between adsorbed atoms.** Freitas, S.R. de (Pernambuco Univ., Recife, PE (Brazil). Dept. de Fisica); Melo, C.P. de. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. HYDROGEN/adsorption; FERMI LEVEL; HYDROGEN; ADSORPTION; ONE-DIMENSIONAL CALCULATIONS; RELAXATION; SUBSTRATES; TUNGSTEN

2070 (INIS-BR–2933, pp. 374) **Determination of hydrogen evolution in a-Si:H, a-C:H and a-SiC:H thin films.** Achete, C.A. (Universidade Federal, Rio de Janeiro, RJ (Brazil). Coordenacao dos Programas de Pos-graduacao de Engenharia); Cunha, J. da; Freire Junior, F.L. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. HYDROGEN/diffusion; CARBON; CRYSTAL STRUCTURE; HYDROGEN; DIFFUSION; QUANTITY RATIO; SILICON; THIN FILMS

2071 (JINR-R–2-90-529) **Quasipotential of two-particle system and the infrared singularities.** Bojkova, N.A. (Saratovskij Gosudarstvennyj Univ., Saratov (Russian Federation)); Dvoeglazov, V.V.; Tyukhtyaev, Yu.N.; Faustov, R.N. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Theoretical Physics. 1990. 11p. (In Russian). Order Number DE93606188. Source: OSTI; NTIS (US Sales Only); INIS.

The influence of the binding effects on the calculation of the corrections to ground state hyperfine splitting in muonium and positronium is analyzed. Main attention is paid to the problem of cancelation of anomalously large contributions caused by the quasipotential behaviour in the infrared region. Advantages of the quasipotential approach based on the two-time Green function are discussed. 20 refs.; 2 figs.; 2 tabs.

2072 (JINR-R–2-91-3) **Form factors of transition of hydrogen-like atoms between discrete and continuous spectrum states.** Tarasov, A.V.; Khristova, I.U. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems. 1991. 4p. (In Russian). Order Number DE93606189. Source: OSTI; NTIS (US Sales Only); INIS.

Explicit expressions are obtained for form factors of transition of hydrogen-like atoms from an arbitrary stationary state to continuous spectrum states. 4 refs.

6642 Spectra of Atoms and Molecules and Their Interactions With Photons

Refer also to citation(s) 2422, 2423, 2424

2073 (BARC–1991/E/019) **Spectral line profile analysis for evaluation of Gaussian and Lorentzian widths and collisional broadening coefficient.** Nakhate, S.G. (Bhabha Atomic Research Centre, Bombay (India). Spectroscopy Div.); Ahmad, S.A.; Pushpa; Rao, M.; Saksena, G.D. Bhabha Atomic Research Centre, Bombay (India). 1991. 21p. Order Number DE93606191. Source: OSTI; NTIS (US Sales Only); INIS.

Deconvolution of atomic line profiles, recorded on PC interfaced recording Fabry-Perot spectrometer, into its Lorentzian and Gaussian component has been carried out. Effect of various parameters of hollow cathode discharge lamp (light source) such as discharge current, bath temperature and gas pressure on Lorentzian and Gaussian width has been studied. The value of the self-broadening coefficient for neon-neon atomic interaction for the transition $2p^54P\text{-}2P^53s$ (λ=3472.571 A) has been determined. (author). 15 refs., 6 figs., 4 tabs.

2074 (DOE/ER/14161–1) **Spectroscopic investigation of the vibrational quasi-continuum arising from internal rotation**

of a methyl group: Progress report, September 15, 1990–September 14, 1991. Hougen, J.T. National Inst. of Standards and Technology, Gaithersburg, MD (United States). Molecular Physics Div. [1991]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AI05-90ER14161. Order Number DE92040509. Source: OSTI; NTIS; GPO Dep.

The goal of this project is to use spectroscopic techniques to investigate in detail phenomena involving the vibrational quasicontinuum in a simple physical system. Acetaldehyde was chosen for the study because: (1) methyl groups are known to be important promotors of intramolecular vibrational relaxation; (2) the internal rotation of a methyl group is an easily describable large-amplitude motion, which should retain its simple character even at high levels of excitation, and (3) the aldehyde carbonyl group offers the possibility of both vibrational and electronic probing. The present investigation of the ground electronic state has three parts: (1) understanding the "isolated" internal-rotation motion below, at, and above the top of the torsional barrier, (2) understanding in detail traditional vibrational fundamental and overtone states, and (3) understanding interactions involving states with multiquantum excitations of at least one of these two kinds of motion. Progress during the first nine months of this project will be described under these three headings.

2075 (IC–92/176) **On the acceptor-related photoluminescence spectra of GaAs quantum-wire microcrystals: A model calculation.** Oliveira, L.E. (International Centre for Theoretical Physics, Trieste (Italy)); Porras Montenegro, N.; Latge, A. International Centre for Theoretical Physics, Trieste (Italy). Jul 1992. 15p. Order Number DE93606192. Source: OSTI; NTIS (US Sales Only); INIS.

The acceptor-related photoluminescence spectrum of a GaAs quantum-wire microcrystal is theoretically investigated via a model calculation within the effective-mass approximation, with the acceptor envelope wave functions and binding energies calculated through a variational procedure. Typical theoretical photoluminescence spectra show two peaks associated to transitions from the n = 1 conduction subband electron gas to acceptors at the on-center and on-edge positions in the wire in good agreement with the recent experimental results by Hirum et al. (Appl. Phys. Lett. 59, 431 (1991)). (author). 14 refs, 3 figs.

2076 (INIS-BR–2933, pp. 261) **Two-fold photon statistics of the subthreshold degenerate parametric oscillator.** Brito, A.L. de (Arkansas Univ., Fayetteville, AR (USA). Dept. of Physics); Vyas, R. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. PHOTONS/oscillators; PHOTONS/statistics; GAUSSIAN PROCESSES; PHOTONS; OSCILLATORS; STATISTICS

2077 (KAERI/RR–1043/91) **Study on laser atomic spectroscopy.** Lee, Jong Min (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Song, Kyu Seok; Jeong, Do Young; Kim, Chul Joong; Han, Phil Soon. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Jan 1992. 235p. (In Korean). Order Number DE93606193. Source: OSTI; NTIS (US Sales Only); INIS.

Electric discharge type atomic vaporizer is developed for the spectroscopic study on actinide elements. Laser induced fluorescence study on actinide elements is performed by using this high temperature type atomizer. For the effective photoionization of elements, copper vapor laser pumped dye laser and electron beam heating type atomic vaporizer are built and their characteristics are measured. In addition, resonance ionization mass spectroscopic analysis for lead sample as well as laser induced fluorescence study on uranium sample in solution phase is made. (Author).

2078 (SINS–2106/A, pp. 68-74) **The X-ray spectra of Ta and U following the collisions with energetic ions.** Anagnostopoulos, D.F. (Forschungszentrum Juelich GmbH (Germany). Inst. fuer Kernphysik); Borchert, G.L.; Gotta, D.; Rashid, K. Institute of Atomic Energy, Otwock-Swierk (Poland). Nov 1990. (CONF-900857–: 21. Mikolajki summer school on nuclear physics: nuclear and atomic physics with accelerators of the nineties, Mikolajki (Poland), 26 Aug - 5 sep 1990). In *Nuclear and atomic physics with the accelerators of the nineties: Proceedings of the 21st Mikolajki summer school on nuclear physics, held in Mikolajki, Poland, August 26 - September 5, 1990. Seminars.* 111p. Order Number DE93604421. Source: OSTI; NTIS (US Sales Only); INIS.

We have performed a high resolution study of the satellite structure of K X-rays in Ta and U produced by energetic heavy ion bombardment. The experimental results are compared with theoretical predictions based on the semiclassical approximation. We discuss the importance of L subshell coupling, charge transfer from the L shell of the target to the K shell of the projectile, vacancy redistribution during the life time of the K hole's angular momentum coupling with the open shells. We find very good agreement between theory and experiment, nevertheless a small discrepancy in the vicinity of the diagram lines remains. (author).

2079 (SINS–2106/A, pp. 75-79) **M-shell ionization probabilities in central collisions with energetic α projectiles.** Carlen, M. (Fribourg Univ. (Switzerland). Inst. de Physique); Dousse, J.Cl.; Gasser, M.; Kern, J.; Rheme, Ch.; Rymuza, P.; Sujkowski, Z.; Trautmann, D. Institute of Atomic Energy, Otwock-Swierk (Poland). Nov 1990. (CONF-900857–: 21. Mikolajki summer school on nuclear physics: nuclear and atomic physics with accelerators of the nineties, Mikolajki (Poland), 26 Aug - 5 sep 1990). In *Nuclear and atomic physics with the accelerators of the nineties: Proceedings of the 21st Mikolajki summer school on nuclear physics, held in Mikolajki, Poland, August 26 - September 5, 1990. Seminars.* 111p. Order Number DE93604421. Source: OSTI; NTIS (US Sales Only); INIS.

The Kβ x-ray spectra of Mo, Pd and La bombarded by 28 MeV ^{4}He ions were measured with a transmission curved crystal spectrometer. M-shell ionization probabilities in central collisions were deduced from the M satellite lines of the Kβ_2 transitions. A comparison of the values obtained for Mo, Pd and La with theoretical (SCA) predictions demonstrates the importance of the recoil term. (author).

6643 Collision Phenomena

Refer also to citation(s) 1147, 2073, 2164

2080 (CONF-9204186–) **Future directions in electron–ion collision physics.** Reed, K.J. (ed.) (Lawrence Livermore National Lab., CA (United States)); Griffin, D.C. (ed.). Lawrence Livermore National Lab., CA (United States). [1992]. 211p. Sponsored by USDOE, Washington, DC (United States); Department of Defense, Washington, DC (United States); National Science Foundation, Washington, DC (United States); Clark Atlanta Univ., GA (United States). DOE Contract W-7405-ENG-48. From Future direction in electron-ion collision physics; Atlanta, GA (United States); 9-10 Apr 1992. Order Number DE93000500. Source: OSTI; NTIS; INIS; GPO Dep.

This report discusses the following topics: Summary of session on synergistic co-ordination of theory and experiment; synergism between experiment and theory in atomic physics; comparison of theory and experiment for electron-ion excitation and ionization; summary of session on new theoretical and computational methods; new theoretical and computational methods-r-matrix calculations; the coulomb three-body problem: a progress report; summary of session on needs and applications for electron-ion collisional data; electron-ion collisions in the plasma edge; needs and applications of theoretical data for electron impact excitation; summary of session on relativistic effects, indirect effects, resonance, etc; direct and resonant processes in electron-ion collisions; relativistic calculations of electron impact ionization and dielectronic recombination cross section for highly charged ions; electron-ion recombination in the close-coupling approximation; modified resonance amplitudes with strongly correlated channels; a density-matrix approach to the broadening of spectral lines by autoionization, radiative transitions and electron-ion collisions; towards a time-dependent description of electron-atom/ion collisions two electron systems; and comments

on inclusion of the generalized bright interaction in electron impact excitation of highly charged ions.

2081 (IC–92/147) **Excitation of atomic hydrogen.** Tiwary, S.N. (International Centre for Theoretical Physics, Trieste (Italy)); Singh, D.D. International Centre for Theoretical Physics, Trieste (Italy). Jul 1992. 9p. Order Number DE93604639. Source: OSTI; NTIS (US Sales Only); INIS.

We have calculated the angular differential cross sections for the optically forbidden excitation $e^-+H(1s) \rightarrow e^-+H(2s)$ as well as the optically allowed excitation $e^-+H(1s) \rightarrow e^-+H(2p)$ transitions in the hydrogen atomic system by electron impact using the basic functions (1s-2s-2p) within the R-matrix method. Comparison is made with experimental and theoretical results. (author). 33 refs, 1 fig.

2082 (IC–92/148) **Oscillator strengths for P V, S VI, Cl VII, Ar VIII and K IX.** Tiwary, S.N. (International Centre for Theoretical Physics, Trieste (Italy)); Kumar, M.; Singh, D.D.; Kumar, P. International Centre for Theoretical Physics, Trieste (Italy). Jul 1992. 14p. Order Number DE93604640. Source: OSTI; NTIS (US Sales Only); INIS.

Optical oscillator strengths, of both the length and velocity forms, for the inner-shell excitation $1s^22s^22p^63s\ ^2S^e \rightarrow 1s^22s^22p^53s^2\ ^2P^o$ transition, which leads to autoionization (Auger transition) in P V, S VI, Cl VII, Ar VIII and K IX ions of the sodium isoelectronic sequence have been calculated using the approach suggested by one of the authors (Tiwary) in the case of Fe XVI ion. Our present calculated results demonstrate that the Tiwary approach is capable of yielding encouraging results. (author). 22 refs, 11 tabs.

2083 (JINR-R–4-91-129) **The yield of resonances in the He(e, 2e)He$^+$ reaction depending on the ejection angle.** Lkhagva, O.; Strakhova, S.I.; Badamdamdin, R.; Khehnmehdehkh, L. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Theoretical Physics. 1991. 14p. (In Russian). Order Number DE93606205. Source: OSTI; NTIS (US Sales Only); INIS.

In the first Born approximation the interference and relation of the yields of overlapping ^1P and ^1D autoionization states (AIS) in the He(e,2e)He$^+$ reaction in the dependence on the ejection angle in a wide region of kinematic variables are considered. It is shown that in the quasi-elastic peak region there exists a region of ejection angles for which at certain kinematic situations the resonance contributions of the ^1P and ^1D AIS lead to the complicated asymmetric structure in the spectrum triple differential oscillator strengths. In the recoil peak these resonances, as a rule, are fairly isolated and the relation of their yields varies noticeably depending on kinetic variables. 17 refs.; 7 figs.; 1 tab.

2084 (LBL–32515) **Reaction dynamics and photochemistry of divalent systems.** Davis, H.F. Lawrence Berkeley Lab., CA (United States). May 1992. 311p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. Order Number DE92041173. Source: OSTI; NTIS; GPO Dep.

Results are presented of molecular beam studies of bimolecular and unimolecular reactions of Ba. Chapter 1 discusses the reaction Ba + NO_2. Formation of the dominant $BaO(^1\Sigma)$ + NO products resulted primarily from decay of long-lived $Ba^+NO_2^-$ collision complexes. Secondary mechanisms led to formation of forward scattered, internally excited BaO, and BaNO + O. D_o(Ba-NO) = 65±20 kcal/mol. Reactions of ground state and electronically excited Ba with water and alcohols are examined in Chapter 2. Reaction of $Ba(^1S)$ + H^2O led to BaO + H_2, whereas excited state $Ba(^1D)$ + H_2O reacted to form BaOH + H. Collisions between Ba and CH_3OH led to $BaOCH_3$ + H. Radical channels involve H-atom migration and are promoted by excitation of the incident Ba atom. In Chapter 3, reactions of $Ba(^1S)$ with ClO_22 and O_3 are discussed. Again, direct and complex mechanisms were observed. Formation of BaCl + O_2 from decomposition of $Ba^+ClO_2^-$ accounted for 10% of total reaction crass section. Although Ba + O_3 → BaO + 0_2 occurs primarily by direct reaction mechanisms, the secondary channel Ba + 0_3 → BaO_2 + 0 involved decay of long lived $Ba^+O_3^-$ intermediates. $D_o(Ba-O_2)$ = 120 ±20 kcal/mol. Photodissociation dynamics of NO_3 is explored in chapter 4. Visible excitation leads to formation of NO + 0_2 and NO_2 + O. Wavelength dependence of branching ratios is investigated. D_o(O-NO_2) = 48.55 kcal/mole ;and calculate $\Delta H_f(NO_3)$ = 17.75 kcal/mole (298K). Chapter 5 discusses the photodissociation of OClO in a molecular beam. Although $ClO(^2\Pi)$ + $O(^3P)$ is dominant, $Cl(^2P)$ + O_2 also forms, with a max yield of 3.9±0.8% near 404nm.

6644 Experimentally Derived Information On Atomic and Molecular Properties

Refer also to citation(s) 2346

2085 (DOE/ER/13394–T2) **Studies of autoionizing states relevant to dielectronic recombination: Progress report.** Gallagher, T.F. Virginia Univ., Charlottesville, VA (United States). Dept. of Physics. Apr 1992. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-85ER13394. Order Number DE93001849. Source: OSTI; NTIS; INIS; GPO Dep.

In the past year we have focused most of our effort on the study of the 3pnl autoionizing states of Mg. Specifically, we have measured the angular distributions of electrons ejected from these states, we have carried out theoretical analyses of the experimentally determined angular distributions, and we have also made measurements of the autoionization rates of Mg 3pnk Stark states in electric fields. Finally, we have recorded the spectra of the autoionizing Ba 6pnk Stark states with very high optical powers to see the fine details in the wings of the spectra. Each of these activities is described in more detail in the ensuing paragraphs.

2086 (DOE/ER/13491–577) **[Atomic physics with highly charged ions]: Progress report.** Richard, P. Kansas State Univ., Manhattan, KS (United States). J.R. MacDonald Lab. [1992]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-86ER13491. Order Number DE93001386. Source: OSTI; NTIS; INIS; GPO Dep.

Short communication MULTICHARGED IONS/ion-atom collisions; PROGRESS REPORT; CROSS SECTIONS; SPECTROSCOPY

6645 Special Atoms and Molecules

2087 (IC–92/168) **A tight binding model for the electronic structure of FCC and SC C_{60}.** Tit, N.; Kumar, V. International Centre for Theoretical Physics, Trieste (Italy). Jul 1992. 5p. Order Number DE93606214. Source: OSTI; NTIS (US Sales Only); INIS.

Ab-initio calculations for K_3C_{60} indicate that the general features of the energy bands within LDA remain nearly unchanged as compared to C_{60}. In the electron-phonon pairing mechanism of superconductivity in these materials, the variation in T_c has been attributed to changes in the lattice constant which affects $N(E_F)$. We have therefore, fitted the valence and conduction bands of the fcc C_{60}, obtained by Troullier and Martins from an LDA plane wave basis calculations, with a tight binding model and studied the energy bands as a function of the lattice constant. As the overlap between orbitals on neighbouring balls is small, the band width is found to decrease by about 30% in going from K_3C_{60} to Rb_2CsC_{60}. The density of states, thus, obtained is used to estimate variation in T_c from McMillian's formula. These results are in good agreement with experimental data. Calculations of the energy bands are also presented for the low temperature Pa3-bar structure. (author). 12 refs, 3 figs, 1 tab.

2088 (LA-UR–92-3046) **Muon physics with the proposed Pulsed Lepton Source at LAMPF.** Leon, M.; Paciotti, M.A. Los Alamos National Lab., NM (United States). [1992]. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-9206276–2: Muon '92 workshop, Uppsala (Sweden), 28 Jun - 3 jul 1992). Order Number DE93000657. Source: OSTI; NTIS; INIS; GPO Dep.

The Pulsed Lepton Source (PLS) project opens some exciting possibilities for muon and neutrino physics . The PLS would use the 0.25 4s proton pulses from the upgraded Proton Storage Ring (PSR) at LAMPF to create short, intense bursts of muons and neutrinos. The neutrino beam would be used for a few fundamentally important weak interaction physics experiments. The muon beams would find a wide variety of applications in both fundamental and "applied" muon physics areas. After a brief discussion of the physical layouts of the PSR and the proposed PLS in Sec. 2 and muon area in Sec. 3, we note some of the muon physics experiments

and areas that could advantageously be addressed at the PLS in Secs. 4 and 5, and conclude in Sec. 6.

2089 (SLAC-PUB–5939) **Production of relativistic antihydrogen atoms by pair production with positron capture and measurement of the Lamb shift.** Munger, C.T. (Stanford Linear Accelerator Center, Menlo Park, CA (United States)); Brodsky, S.J.; Schmidt, I. Stanford Linear Accelerator Center, Menlo Park, CA (United States). Sep 1992. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00515. (CONF-9207149–2: Hyperfine interactions of the anti-hydrogen workshop, Munich (Germany), 30-31 Jul 1992). Order Number DE93001767. Source: OSTI; NTIS; INIS; GPO Dep.

A beam of relativistic antihydrogen atoms-the bound state $(\bar{p}e^+)$– can be created by circulating the beam of an antiproton storage ring through an internal gas target. An antiproton which passes through the Coulomb field of a nucleus will create e^+e^- pairs, and antihydrogen will form when a positron is created in a bound instead of continuum state about the antiproton. The cross section for this process is roughly I Z^2 pb for antiproton momenta above 6 GeV/c. A sample of 200 antihydrogen atoms in a low-emittance, neutral beam will be made in 1994 as an accidental byproduct of Fermilab experiment E760. We describe a simple experiment, Fermilab Proposal P862, which can detect this beam, and outline how a sample of a few-10^4 atoms can be used to measure the antihydrogen Lamb shift to 1%.

6650 Physics of Condensed Matter

Refer also to citation(s) 967, 1012, 1027, 2075, 2471

2090 (DOE/ER/45431–2) **First-principles studies of phase stability and the structural and dynamical properties of metal hydrides: Progress report, September 15, 1991–September 14, 1992.** Chou, M.Y. Georgia Inst. of Tech., Atlanta, GA (United States). School of Physics. Apr 1992. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-90ER45431. Order Number DE92040855. Source: OSTI; NTIS; GPO Dep.

This report discusses the following topics: calculation of the Structural Properties of Yttrium; dynamical and pairing properties of α-YH_X; electronic and structural properties of YH_2 and YH_3; phase diagram of hydrogen on Ru(000); peierls distortion in hexagonal YH_3; and study of hydrogen in niobium and palladium.

2091 (IC–92/160) **The thermodynamic and structural contributions to the vacancy formation energies in hot rare gas solids.** Rashid, R.I.M.A. International Centre for Theoretical Physics, Trieste (Italy). Jul 1992. 5p. Order Number DE93604742. Source: OSTI; NTIS (US Sales Only); INIS.

For the case of close-packed hot rare gas crystals, the vacancy formation energy E_v is expressed in terms of thermodynamic quantities at melting temperatures and contributions from state dependent structure. It is found that in the determination of the vacancy formation energy the thermodynamic term dominates. The structural contributions can be estimated from diffraction experiments and molecular dynamic data and are shown to be insignificant compared to the contributions of thermodynamic terms in argon and krypton. However, the structural corrections for neon are found to be moderate, suggesting that the three-body effects are important in neon. (author). 15 refs.

2092 (IC–92/191) **Electronic states in quantum wells with periodically structured interfaces.** Sun Hong. International Centre for Theoretical Physics, Trieste (Italy). Aug 1992. 20p. Order Number DE93606295. Source: OSTI; NTIS (US Sales Only); INIS.

The electronic energy sub bands and minigaps in Lateral-Surface-Superlattices (LSSLs) produced by deposition of A1As and GaAs fractional layers on (001) vicinal GaAs substrates were predicated by variational calculations. A coordinate transformation was introduced in the calculation which transforms the LSSLs with periodically structured interfaces to quantum wells with planar interfaces so that the boundary conditions of the electronic wave functions on the LSSL interfaces can be satisfied exactly. The calculations showed that our theory gives lower subband energies than those predicated by other variational calculations. The dependence of the energy minigaps between the first and second subbands on the LSSL structural parameters, such as the average widths of the LSSLs and the periods of their interface structures, was investigated. In the calculation, the barrier between GaAs and AlAs was assumed to be finite (=1.06eV) and infinite. The infinitely high potential barrier approximation (IHPBA) overestimates the energy minigap by 50% when the average width of the LSSL is 100A, and it reduces to 25% when the width is 200A. IHPBA does not work well when the average widths of the LSSLs are less than 200A. (author). 14 refs, 5 figs.

2093 (INIS-BR–2933) **Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.** Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Studies on atomic and molecular physics, crystallography, statistical physics and critical phenomena, instrumentation, liquid crystals, magnetism, metals and alloys, magnetic resonance, superconductivity and semi-conductors are presented. (M.C.R.).

2094 (INIS-BR–2933, pp. 232) **Effective range theory in Peierls-Hubbard systems.** Lara, G.A. (Universidade Estadual de Campinas, SP (Brazil). Inst. de Fisica); Lagos, R.E. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. ELECTRON-ELECTRON INTERACTIONS/effective range theory; ELECTRON-PHONON COUPLING; SPIN WAVES

2095 (INIS-BR–2933, pp. 366) **Formation of the initial layer of iron nitrides in post-discharge nitridation by CEMS and CXMS.** Figueiredo, R.S. (Santa Catarina Univ., Florianopolis, SC (Brazil). Dept. de Fisica); Souza, A.R. de; Drago, V. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. IRON NITRIDES/moessbauer effect; LAYERS; NITRIDATION

2096 (INIS-BR–2933, pp. 366) **Formation of the initial layer of iron nitrides in ion nitridation by CEMS and CXMS.** Figueiredo, R.S. (Santa Catarina Univ., Florianopolis, SC (Brazil). Dept. de Fisica); Drago, V. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. LAYERS/nitridation; DEPTH; DIFFUSION; IRON NITRIDES; LAYERS; NITRIDATION; MOESSBAUER EFFECT; NITROGEN; TEMPERATURE RANGE 0400-1000 K; X-RAY SPECTROSCOPY

2097 (LBL–32279) **On canonical cylinder sections for accurate determination of contact angle in microgravity.** Concus, P. (Lawrence Berkeley Lab., CA (United States)); Zabihi, F.; Finn, R. Lawrence Berkeley Lab., CA (United States). Jul 1992. 8p. Sponsored by USDOE, Washington, DC (United States); National Aeronautics and Space Administration, Washington, DC (United States); National Science Foundation, Washington, DC (United States). DOE Contract AC03-76SF00098. Grant NAG3-1143;Grant DMS89-02831. (CONF-921110–29: Winter annual meeting of the American Society of Mechanical Engineers, Anaheim, CA (United States), 8-13 Nov 1992). Order Number DE93000635. Source: OSTI; NTIS; GPO Dep.

Large shifts of liquid arising from small changes in certain container shapes in zero gravity can be used as a basis for accurately determining contact angle. "Canonical" geometries for this purpose,

recently developed mathematically, are investigated here computationally. It is found that the desired "nearly- discontinuous" behavior can be obtained and that the shifts of liquid have sufficient volume to be readily observed.

6651 Nuclear Techniques in Condensed Matter Physics

Refer also to citation(s) 988, 999, 1070, 1098, 1111, 1436, 2224

2098 (CEA-CONF–10996) **Study of deuterium diffusion in amorphous $Zr_3RhD_{4.3}$ by ^{181}Ta spin relaxation.** Baudry, A. (CEA Centre d'Etudes de Grenoble, 38 (France). Dept. de Recherche Fondamentale sur la Matiere Condensee); Boyer, P.; Ferreira, L.P. CEA Centre d'Etudes de Grenoble, 38 (France). Direction des Sciences de la Matiere. 1992. 7p. (CONF-9206175–: Interaction symposium on metal-hydrogen systems, Uppsala (Sweden), Jun 1992). Order Number DE93721105. Source: OSTI; NTIS (US Sales Only); INIS.

The diffusion of deuterium in amorphous $Zr_3RhD_{4.3}$ was studied by γ-γ Perturbed Angular Correlations (PAC) using ^{181}Ta as a quadrupole probe in substitution for Zr. The temperature dependence of the spin relaxation rate is well reproduced assuming a Gaussian distribution of activation energies with a relative width of about 20% around a mean value $E_a = 0.14(2)eV$. The results support the idea that deuterium diffuses mostly between face-shared 4Zr tetrahedra. Such easy diffusion, paths could be interrupted by 'traps', as suggested by comparing our PAC data with NMR data on a-Zr_3RhH_x.

2099 (CEA-CONF–10997) **Diffusion of positive muon and hydrogen in Hf_2CoH_x compounds.** Baudry, A. (CEA Centre d'Etudes de Grenoble, 38 (France). Dept. de Recherche Fondamentale sur la Matiere Condensee); Boyer, P.; Pontonnier, L.; Miraglia, S.; Harris, S.W.; Ferreira, L.P.; Ayres de Campos, N. CEA Centre d'Etudes de Grenoble, 38 (France). Direction des Sciences de la Matiere. 1992. 3p. (CONF-9206175–: Interaction symposium on metal-hydrogen systems, Uppsala (Sweden), Jun 1992). Order Number DE93721106. Source: OSTI; NTIS (US Sales Only); INIS.

In recent years, the diffusional motion of hydrogen and its isotopes - including the positive muon - in intermetallic lattices has been extensively studied. A valuable way to get a deeper insight into the diffusion mechanisms is to compare the hopping frequencies of different hydrogen isotopes in a large temperature range. It is known that both H f_2Co and H f_2CoH_x ($x < 3.5$) display a Ti_2Ni - type cubic structure. However, the arrangement of hydrogen atoms in the available interstitial sites in Hf_2CoH_x is not presently known. It is nevertheless reasonable to consider that the occupancies determined by neutron diffraction for the isostructural compounds Hf_2FeH_x remain valid in H f_2CoH_x. Thus, most hydrogen atoms (>80%) are expected to stay in 3Hf-1Co tetrahedra for $x<3$. Tetrahedral holes with a 2Hf-2Co coordination can be significantly occupied for higher H concentrations. In spite of favourable factors such as chemical affinity and geometry, octahedral 6Hf sites remain remarkably empty.

2100 (CEA-CONF–11036) **Inelastic neutron scattering study of the spin dynamics in the high temperature superconducting system $YBa_2Cu_3O_{6+x}$.** Regnault, L.P. (CEA Centre d'Etudes de Grenoble, 38 (France). Dept. de Recherche Fondamentale sur la Matiere Condensee); Burlet, P.; Henry, J.H.; Rossat-Mignod, J.; Bourges, P. CEA Centre d'Etudes de Grenoble, 38 (France). Dept. de Recherche Fondamentale sur la Matiere Condensee. 1992. 32p. (CONF-9204203–: Gentnet-Kastler Price, Berlin (Germany), 1 Apr 1992). Order Number DE93721681. Source: OSTI; NTIS (US Sales Only); INIS.

We report on inelastic neutron scattering experiments carried out on single-crystals of the $YBa_2Cu_3O_{6+x}$ system. The spin dynamics has been systematically investigated in the six typical regimes: the pure and doped AF states ($x = 0.15, 0.37$), the weakly doped ($x = 0.45, 0.51$), the heavily doped ($x = 0.69, 0.92$) and the overdoped ($x = 1$) metallic states which all exhibit a superconducting ground state. The hole doping strongly affects the AF-order, dynamical QF-correlations remain in the metallic state. An energy gap has been discovered in the spin excitation spectrum of any superconducting samples, however, it becomes weaker close to the I-M transition. A quite unusual T-dependence of the spin excitation spectrum was found. (author). 22 refs., 18 figs.

2101 (DOE/ER/45445–4) **Surface physics with cold and thermal neutron reflectometry: Progress report, April 1, 1991–March 31, 1992.** Steyerl, A. Rhode Island Univ., Kingston, RI (United States). Nov 1991. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-91ER45445. Order Number DE93001986. Source: OSTI; NTIS; INIS; GPO Dep.

Three aspects of the research project "Surface physics with cold and ultracold neutron reflectometry" were stressed during the present first year: (1) Setup of the reflectometer facility at the research reactor of the Rhode Island Nuclear Science Center. The installation provides a narrow "pencil beam" analyzed by time of flight using a chopper system. Following beam characterization and a test measurement of the total cross section of copper single crystal first reflectivity measurements are currently performed using a supermirror. (2) Design stud for the ultracold neutron imaging system, with involvement of the relevant industry. Bids are available for several components indicating that it will be very difficult to build the entire system unless further funds become available. (3) Analysis of features of neutron reflection from surfaces with special emphasis on the effect of surface roughness both on the specular beam and the diffusely reflected and refracted intensity. Previous theoretical studies were supplemented by further numerical calculations of diffuse scattering distributions using different models. Application of ultracold and cold neutron reflectometry to the study of liquid-vapor phase transition were discussed. The theoretical work also includes the development of tentative ideas for novel fundamental physics experiments.

2102 (INIS-BR–2933, pp. 216) **Synthesis of GaAs by SSD (Synthesis, Solute Diffusion) technique.** Carvalho, A.T.G. (Vicosa Univ., MG (Brazil). Dept. de Fisica); Oliveira, A.G.; Carvalho, R.S. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. GALLIUM ARSENIDES/ synthesis; DIFFUSION; SYNTHESIS; MONOCRYSTALS; X-RAY DIFFRACTION

2103 (INIS-BR–2933, pp. 217) **Study on characterization, compacting and sintering of aluminia almimg to translucency properties.** Santos Coelho, E. dos (Fundacao de Tecnologia Industrial (FTI), Lorena, SP (Brazil). Centro de Materiais Refratarios); Pinatti, D.G.; Gomes, U.U. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. ALUMINIUM OXIDES/x-ray diffraction; COMPACTING; GRAIN SIZE; MECHANICAL TESTS; MICROSTRUCTURE; POWDERS; SCANNING ELECTRON MICROSCOPY; SINTERING

2104 (INIS-BR–2933, pp. 219) **Magnetic and structural characterization of nanocrystalline ferromagnets.** Knobel, M. (Universidade Estadual de Campinas, SP (Brazil). Inst. de Fisica); Turtelli, R.S.; Cruz Filho, S.P. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. FERROMAGNETIC MATERIALS/magnetic susceptibility; AMORPHOUS STATE; HEAT TREATMENTS; MAGNETIZATION; STRUCTURE FACTORS; TEMPERATURE RANGE 0400-1000 K; X-RAY DIFFRACTION

2105 (INIS-BR–2933, pp. 220) **Stacking fault energy of Fe-20Cr-10Ni and Fe-18Cr-16Ni.** Martinez, L.G. (Instituto de Pesquisas Energeticas e Nucleares (IPEN), Sao Paulo, SP (Brazil)); Imakuma, K. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. AUSTENITIC STEELS/stacking faults; STAINLESS STEELS; X-RAY DIFFRACTION

2106 (INIS-BR–2933, pp. 227) **Measurements of electromagnetic hyperfine fields in Gd_2In alloys.** Olzon-Dionysio, M. (Sao Carlos Univ., SP (Brazil). Dept. de Fisica); Souza, S.D. de; Forker, M. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. INDIUM ALLOYS/hyperfine structure; CADMIUM 111; COINCIDENCE SPECTROMETRY; DIFFERENTIAL PAC; ELECTROMAGNETIC FIELDS; GADOLINIUM ALLOYS; GAMMA CASCADES; INDIUM 111; TEMPERATURE RANGE 0065-0273 K

2107 (INIS-BR–2933, pp. 227) **Moessbauer measurements at high temperature in $Al_{65}Cu_{20}Fe_{15}$ quasicrystal.** Araujo, J.H. de (Rio Grande do Sul Univ., Porto Alegre, RS (Brazil). Inst. de Fisica); Cunha, J.B.M. da; Vasquez, A. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. ALLOY SYSTEMS/moessbauer effect; ALUMINIUM; COPPER; F CENTERS; IRON; IRON 57; QUADRUPOLES

2108 (INIS-BR–2933, pp. 227) **Electric field gradient in nucleus of transition metal alloys.** Petrilli, H.M. (Sao Paulo Univ., SP (Brazil). Inst. de Fisica); Frota-Pessoa, S. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. CRYSTAL STRUCTURE/moessbauer effect; ELECTRIC FIELDS; IRON; ZIRCONIUM ALLOYS

2109 (INIS-BR–2933, pp. 230) **Preparation of Fe/Cr alloys by mechanical milling method: structural and magnetic characterization.** Rodrigues, V.A.P. (Centro Brasileiro de Pesquisas Fisicas (CBPF), Rio de Janeiro, RJ (Brazil)); Baggio-Saitovitch, E.M.; Larica, C.; Sike, X.; Lima, J.C. de; Sarkissian, B. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. ALLOY SYSTEMS/magnetic susceptibility; CHROMIUM; IRON; MILLING; MOESSBAUER EFFECT; ORDER PARAMETERS; X-RAY DIFFRACTION

2110 (INIS-BR–2933, pp. 230) **Microstructures and mechanical properties of quick-freezing nickel aluminates (Ni_3Al).** Ferreira, P.I. (Instituto de Pesquisas Energeticas e Nucleares (IPEN), Sao Paulo, SP (Brazil)); Lima, M.S.F. de. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. MICROSTRUCTURE/x-ray diffraction; ALUMINATES; FREEZING; MICROHARDNESS; MICROSTRUCTURE; NICKEL COMPOUNDS; TENSILE PROPERTIES; TRANSMISSION ELECTRON MICROSCOPY

2111 (INIS-BR–2933, pp. 237) **Moessbauer studies on effects of aging and annealing in $Ag_{1-x}Fe_x$ films.** Sike, X. (Centro Brasileiro de Pesquisas Fisicas (CBPF), Rio de Janeiro, RJ (Brazil)); Latica, C.; Baggio-Saitovitch, E.M. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. FILMS/moessbauer effect; AGING; ANNEALING; FILMS; IRON; PRECIPITATION; SILVER

2112 (INIS-BR–2933, pp. 240) **Effect of silver addition on resistivity of copper base alloys.** Beatrice, C.R.S. (UNESP, Araraquara, SP (Brazil). Inst. de Quimica); Adorno, A.T.; Benedetti, A.V.; Cabot, P.L. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. COPPER BASE ALLOYS/silver additions; ANNEALING; ELECTRIC CONDUCTIVITY; ELECTRON MICROSCOPY; METALLOGRAPHY; TEMPERATURE DEPENDENCE; TEMPERATURE RANGE 0400-1000 K; TEMPERATURE RANGE 1000-4000 K; X-RAY DIFFRACTION

2113 (INIS-BR–2933, pp. 240) **Phase transformations of odontologic alloy of the Cu-Zn-Al-Ni system.** Guastaldi, A.C. (UNESP, Araraquara, SP (Brazil). Inst. de Quimica); Beatrice, C.R.S.; Adorno, A.T. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. COPPER BASE ALLOYS/phase transformations; ALUMINIUM; CORROSION RESISTANCE; HEAT TREATMENTS; NICKEL; SCANNING ELECTRON MICROSCOPY; TEMPERATURE RANGE 0400-1000 K; X-RAY DIFFRACTION; ZINC

2114 (INIS-BR–2933, pp. 292) **Effects induced by ion bombardment on chemical structure and optical properties of PPS (poly paraphenylene sulfide).** Rizzatti, M.R. (Rio Grande do Sul Univ., Porto Alegre, RS (Brazil). Inst. de Fisica); Papaleo, R.M.; Livi, R.P.; Araujo, M.A. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. ORGANIC POLYMERS/argon 40 beams; ORGANIC POLYMERS/boron 10 beams; ORGANIC POLYMERS/helium 4 beams; HYDROGEN IONS 1 PLUS; INFRARED SPECTRA; KEV RANGE 100-1000; OPTICAL PROPERTIES; RADIATION EFFECTS; RUTHERFORD SCATTERING; STRUCTURAL CHEMICAL ANALYSIS

2115 (INIS-BR–2933, pp. 292) **Equivalent chain model for albumin in pH7.** Drigo Filho, E. (UNESP, Sao Jose do Rio Preto, SP (Brazil). Inst. de Biociencias, Letras e Ciencias Exatas); Barlette, V.E.; Ruggiero, J.R.; Olivieri, J.R. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. MOLECULAR STRUCTURE/x-ray diffraction; ALBUMINS; PH VALUE; SMALL ANGLE SCATTERING

2116 (INIS-BR–2933, pp. 293) **Modification of PPS (poly paraphenylene sulfide) crystal structure by ion bombardment.** Rizzatti, M.R. (Rio Grande do Sul Univ., Porto Alegre, RS (Brazil). Inst. de Fisica); Papaleo, R.M.; Livi, R.P.; Araujo, M.A. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. POLYMERS/argon 40 beams; POLYMERS/boron 10 beams; POLYMERS/helium 4 beams; CALORIMETRY; CRYSTAL STRUCTURE; HYDROGEN IONS 1 PLUS; INFRARED SPECTRA; IRRADIATION; POLYMERS; RADIATION DOSES; RADIATION EFFECTS; THERMAL GRAVIMETRIC ANALYSIS; THERMODYNAMIC PROPERTIES

2117 (INIS-BR–2933, pp. 297) **ESR in monocrystalline $AlCl_3$ with Mn^{2+} and Cu^{3+} impurities.** Pires, M.A. (Universidade Estadual de Campinas, SP (Brazil)); Rettori, G.; Barberis, G.E. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

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2118 (INIS-BR–2933, pp. 297) **Study on line shape of conduction electron paramagnetic resonance and localized magnetic impurities.** Moura Walmsley, L.C. de (UNESP, Rio Claro, SP (Brazil). Inst. de Geociencias e Ciencias Exatas). Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

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2119 (INIS-BR–2933, pp. 298) **ESR of calcined tissue apatites.** Rossi, A.M. (Centro Brasileiro de Pesquisas Fisicas (CBPF), Rio de Janeiro, RJ (Brazil)); Pinhal, N.M.; Vugman, N.V. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

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2120 (INIS-BR–2933, pp. 298) **Localized modes in transition element complexes by ESR.** Vugman, N.V. (Universidade Federal, Rio de Janeiro, RJ (Brazil). Inst. de Fisica); Abreu, C.D. de; Pinhal, N.M.; Grillo Neto, M.L. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

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2121 (INIS-BR–2933, pp. 299) **Spin diffusion and spin-lattice relaxation of ^1H in polymer in the presence of small metallic aggregation.** Engelsberg, M. (Pernambuco Univ., Recife, PE (Brazil). Dept. de Fisica); Souza, R.E. de; Yannoni, C.S. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

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2122 (INIS-BR–2933, pp. 299) **Images by nuclear quadrupole resonance.** Pusiol, D.J. (Universidad Nacional de Cordoba (Argentina). Fac. de Matematica, Astronomia y Fisica). Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Spanish). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

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2123 (INIS-BR–2933, pp. 303) **ESR of $Zn(L\text{-}Leucine)_2$ crystals with $^{63}Cu(II)$ impurities.** Steren, C.A. (Consejo Nacional de Investigaciones Cientificas y Tecnicas, Buenos Aires (Argentina). INTEC); Calvo, R. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Spanish). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

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2124 (INIS-BR–2933, pp. 303) **CESR and phase transformations in receiver intercalate graphites.** Gennaro, A.M. (Universidade Estadual de Campinas, SP (Brazil). Inst. de Fisica); Rettori, C.; Barberis, G.E.; Sartori, J.C. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

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2125 (INIS-BR–2933, pp. 303) **Exchange collapse of the EPR lines in a 2-dimensional paramagnet.** Martino, D.M. (Consejo Nacional de Investigaciones Cientificas y Tecnicas, Buenos Aires (Argentina). INTEC); Calvo, R.; Passeggi, M.C.G. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

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2126 (INIS-BR–2933, pp. 304) **Studies on the plane square complex of copper(II)-three-phenyl-arsenic oxide, in the Q band by ESR.** Lima e Lara, M.C.F. (Brasilia Univ., DF (Brazil). Dept. de Fisica); Nascimento, O.R. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics,

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2127 (INIS-BR–2933, pp. 304) **Proton nuclear magnetic resonance in $Ni_{36}Zr_{32}Hf_{32}H_{1.36}$, $Ni_{36}Zr_{32}Hf_{33}H_{1.20}$ and $Ni_{36}Zr_{64}H_{0.50}$ metallic glasses.** Wolney Filho, W. (Goias Univ., Goiania, GO (Brazil). Dept. de Fisica); Titman, J.M.; Havill, R.L. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

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2128 (INIS-BR–2933, pp. 304) **Measurements of spin-lattice relaxation time T_1 of protons in hydrogenated metallic alloys.** Wolney Filho, W. (Goias Univ., Goiania, GO (Brazil). Dept. de Fisica); Titman, J.M.; Havill, R.L. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

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2129 (INIS-BR–2933, pp. 305) **Crystalline and molecular vibrations in $(C_2H_5)_4NFeX_4$ compounds (X Cl, Br).** Partiti, C.S.M. (Sao Paulo Univ., SP (Brazil). Inst. de Fisica); Rechenberg, H.R. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

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2130 (INIS-BR–2933, pp. 306) **Cr(III) electron spin resonance in calcium, gallium and germanium garnet.** Moraes, I.J. (Goias Univ., Goiania, GO (Brazil). Dept. de Fisica); Sartori, J.C.; Nascimento, O.R.; Terrile, M.C. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

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2131 (INIS-BR–2933, pp. 307) **Study on Cu(II) ion chains in Cu(L-glutamine) by ESR.** Casado, N. (Consejo Nacional de Investigaciones Cietificas y Tecnicas, Buenos Aires (Argentina). INTEC); Brondino, C.; Calvo, R.; Nascimento, O.R. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

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2132 (INIS-BR–2933, pp. 307) **The first experience in 2D-exchange NQR technique.** Gonzalez, C.E. (Universidad Nacional de Cordoba (Argentina). Fac. de Matematica, Astronomia y Fisica); Pusiol, D.J. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Spanish). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

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2133 (INIS-BR–2933, pp. 313) **Influence of deposition parameters of Fe thin films of Si <100> and Si <111> in Fe-Si reaction.** Paula, D. de (Rio Grande do Sul Univ., Porto Alegre, RS (Brazil)); Amaral, L.; Souza, J.P. de; Schreiner, W.H. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

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2134 (INIS-BR–2933, pp. 315) **Density of states and Moessbauer hyperfine interactions of Sn compounds.** Terra, J. (Centro Brasileiro de Pesquisas Fisicas (CBPF), Rio de Janeiro, RJ (Brazil)); Guenzburger, D. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

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2135 (INIS-BR–2933, pp. 318) **Epitaxy growth of high quality GaInP/GaAs heterostructures.** Macahdo, A. (TELEBRAS, Campinas, SP (Brazil). Centro de Pesquisas); Omnes, F.; Razeghi, M. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

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2136 (INIS-BR–2933, pp. 320) **Characterization of semiconductor III-V alloy epitaxy layers using x-ray diffractometry.** Souza, C.F. de (TELEBRAS, Campinas, SP (Brazil). Centro de Pesquisas); Carvalho Junior, W.; Gazetta Filho, H. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

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2137 (INIS-BR–2933, pp. 336) **Electrical and structural properties of AuZn/p-GaSb ohmic contact.** Oyama, A.M. (Sao Carlos Univ., SP (Brazil). Dept. de Fisica); Oliveira, R. de; Pizani,

P.S.; Galzerani, J.C.; Cardoso, L.P.; Morelhao, S.L.; Landers, R. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355--: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

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2138 (INIS-BR–2933, pp. 337) **Purification of gallium by physico-chemical processes.** Carvalho, R.S. (Minas Gerais Univ., Belo Horizonte, MG (Brazil). Inst. de Ciencias Exatas); Carvalho, R.P. de. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355--: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

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2139 (INIS-BR–2933, pp. 340) **Influence of interfacial surface of SI <100>, <111> and amorphous on reaction of Fe and SI thin films.** Paula, D. de; Amaral, L.; Souza, J.P. de. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355--: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

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2140 (INIS-BR–2933, pp. 344) **^{57}Ion implantation in superconducting materials.** Marest, G. (Universite Bernard, 43 - Lyon (France). Inst. de Physique Nucleaire); Baggio-Saitovitch, E.M. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355--: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

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2141 (INIS-BR–2933, pp. 344) **Kinetic study on oxygen desorption in Fe: $YBa_2Cu_3O_{7-d}$ superconducting oxides.** Baggio-Saitovitch, E.M. (Centro Brasileiro de Pesquisas Fisicas (CBPF), Rio de Janeiro, RJ (Brazil)); Scorzelli, R.B.; Souza Azevedo, I.; Litterst, F.J.; Micklitz, H.R. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355--: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

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2142 (INIS-BR–2933, pp. 345) **Magnetic ordering in Fe: $YBa_2Cu_3O_7$ superconducting oxides.** Baggio-Saitovitch, E.M. (Centro Brasileiro de Pesquisas Fisicas (CBPF), Rio de Janeiro, RJ (Brazil)); Litterst, F.J. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355--: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

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2143 (INIS-BR–2933, pp. 357) **Study on electronic structure of superconductors at high temperature by x-ray absorption spectroscopy (XAS).** Tolentino, H.C.N. (Laboratorio Nacional de Luz Sincrotron (LNLS), Campinas, SP (Brazil)). Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355--: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

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2144 (INIS-BR–2933, pp. 361) **Characterization of tin oxide thin films deposited of magnetron sputtering.** Soares, M.R. (Rio Grande do Sul Univ., Porto Alegre, RS (Brazil). Inst. de Fisica); Dionisio, P.H.; Baumvol, I.J.R.; Schreiner, W.H. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355--: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

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2145 (INIS-BR–2933, pp. 361) **Dynamics study on resistivity of Fe/FeN multilayers.** Huebler, R. (Rio Grande do Sul Univ., Porto Alegre, RS (Brazil). Inst. de Fisica); Soares, M.R.; Baumvol, I.J.R.; Schreiner, W.H. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355--: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

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2146 (INIS-BR–2933, pp. 361) **Production, chemical, morphological and structural characterization of titanium nitride thin films.** Brasil Junior, W. (Universidade Federal, Rio de Janeiro, RJ (Brazil). Coordenacao dos Programas de Pos-graduacao de Engenharia); Achete, C.; Mattoso, N. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355--: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

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2147 (INIS-BR–2933, pp. 362) **Characterization of silicon nitride thin films deposited by reactive RF sputtering in function of deposition patameters.** Stedile, F.C. (Rio Grande do Sul Univ., Porto Alegre, RS (Brazil). Inst. de Quimica); Baumvol, I.J.R.; Schreiner, W.H.; Freire Junior, F.L. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355--: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

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2148 (INIS-BR–2933, pp. 363) **Obtainment and characterization of tin nitride by reactive sputtering.** Lima, R.S. (Rio Grande do Sul Univ., Porto Alegre, RS (Brazil). Inst. de Fisica); Dionisio, P.H.; Schreiner, W.H.; Achete, C. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. FILMS/crystal structure; DEPOSITION; FILMS; MOESSBAUER EFFECT; QUANTITY RATIO; SPUTTERING; STOICHIOMETRY; TIN NITRIDES; X-RAY DIFFRACTION

2149 (INIS-BR–2933, pp. 363) **Obtainment of Fe and Sn amorphous alloys bu co-evaporation and sputtering.** Hallouche, B. (Rio Grande do Sul Univ., Porto Alegre, RS (Brazil). Inst. de Fisica); Vasquez, A.; Schreiner, W.H.; Teixeira, S.R.; Schmidt, J.E.; Dionisio, P.H.; Achete, C. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. THIN FILMS/sputtering; AMORPHOUS STATE; EVAPORATION; HEAT TREATMENTS; IRON; MAGNETIZATION; MOESSBAUER EFFECT; RUTHERFORD SCATTERING; SILICON; SUBSTRATES; SPUTTERING; TIN; TRANSMISSION ELECTRON MICROSCOPY; X-RAY DIFFRACTION

2150 (INIS-BR–2933, pp. 373) **Characterization of KCl:CuCl amorphous thin films.** Oliveira, L. de (Sao Paulo Univ., Sao Carlos, SP (Brazil). Inst. de Fisica e Quimica); Li, M.S. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

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2151 (INIS-BR–2933, pp. 373) **Diamond obtainment by CVD on Si(100) substrate.** Fritzen, C.L. (Rio Grande do Sul Univ., Porto Alegre, RS (Brazil). Inst. de Fisica); Hinrich, R.; Livi, R.P.; Jornada, J.A.H. da. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. DIAMONDS/chemical vapor deposition; CRYSTAL STRUCTURE; DIAMONDS; SCANNING ELECTRON MICROSCOPY; SILICON; SUBSTRATES; X-RAY DIFFRACTION

2152 (INIS-BR–2933, pp. 374) **Deposition and characterization of amorphous carbon thin films hydrogenated and nitrogenated with diamond type properties.** Franceschini, D.F. (PETROBRAS Quimica S.A. (PETROQUISA), Rio de Janeiro, RJ (Brazil)); Achete, C.A. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. THIN FILMS/amorphous state; CARBON; DEPOSITION; ELECTRIC CONDUCTIVITY; HARDNESS; INFRARED SPECTRA; SILICON; SUBSTRATES; X-RAY DIFFRACTION

2153 (INIS-BR–2933, pp. 375) **Formation of silicides on Cu(100)/Si(100), Cu/Si(111), Cu/a-Si and Cu/a-Si:H interfaces analysed by x-ray diffraction.** Mattoso, N. (Universidade Federal, Rio de Janeiro, RJ (Brazil). Coordenacao dos Programas de Posgraduacao de Engenharia); Achete, C.A. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. INTERFACES/x-ray diffraction; COPPER; DEPOSITION; HYDROGEN; INTERFACES; MONOCRYSTALS; ORIENTATION; SILICIDES; SILICON; SPUTTERING; TEMPERATURE RANGE 0400-1000 K; THIN FILMS

2154 (INIS-BR–2933, pp. 375) **Co/Pd multilayers: preparation and characterization by RX.** Schelp, L.F. (Rio Grande do Sul Univ., Porto Alegre, RS (Brazil). Inst. de Fisica); Schmidt, J.E.; Gomes, A.A. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. LAYERS/crystal structure; COBALT; DEPOSITION; LAYERS; PALLADIUM; SAMPLE PREPARATION; X-RAY DIFFRACTION

2155 (INIS-BR–2933, pp. 375) **Vacuum evaporation deposition of PbS thin films aiming to produce detectors in the range from 1,5 to 3,0 μm.** Mendes, J.F.M. (Instituto de Pesquisa e Desenvolvimento, Rio de Janeiro, RJ (Brazil). Lab. de Materiais); Fernandes, M.S.; Andrade, L.H. de; Oliveira, J.C.S. de. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. CRYSTAL STRUCTURE/x-ray diffraction; DEPOSITION; LEAD SULFIDES; RADIATION DETECTORS; SCANNING ELECTRON MICROSCOPY; SUBSTRATES; THIN FILMS

2156 (INIS-BR–2933, pp. 377) **Characterization of interfaces by x-ray smoothing incidence in dispersive mode.** Bulla, D.A.P. (Sao Paulo Univ., SP (Brazil). Inst. de Fisica); Stojanoff, V. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. INTERFACES/thin films; COBALT; CRYSTAL STRUCTURE; DENSITY; GERMANIUM; INDIUM PHOSPHIDES; INTERFACES; POSITION SENSITIVE DETECTORS; SILICON; X RADIATION; X-RAY SOURCES

2157 (INIS-BR–2933, pp. 378) **Study on non occupied orbits of phthalocyanines by IPES and NEXAFS techniques.** Rocco, M.L.M. (Fritz-Haber-Institut der Max-Planck-Gesellschaft, Berlin (Germany)); Frank, K.H.; Yannoulis, P.; Koch, E.E. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. PHTHALOCYANINES/electronic structure; ABSORPTION; ADSORPTION; COPPER;

MEASURING METHODS; PHOTOEMISSION; PHTHALOCYANINES; SILVER; SURFACES; X RADIATION

2158 (JINR-E-3-90-293) **A new polarized neutrons method for studying depth-inhomogeneously magnetized magnetic films.** Korneev, D.A. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Neutron Physics. 1990. 8p. Order Number DE93606304. Source: OSTI; NTIS (US Sales Only); INIS.

Submitted to Z. Phys., B: Condens. Matter.

The main specific features of the process of polarized thermal neutrons specular reflection from the surface of depth-inhomogeneously magnetic films are considered theoretically. It is shown how using the method of specular reflection of polarized thermal neutrons from such a films surface, one may restore the depth distribution of the local magnetization vector M-vector(z). 9 refs.

2159 (JINR-E-11-90-599) **The demagnetizing factors for the rectangular samples.** Akishin, P.G.; Gaganov, I.A. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems. 1990. 10p. Order Number DE93606303. Source: OSTI; NTIS (US Sales Only); INIS.

The influence of the demagnetization effect on the distribution of internal magnetic fields for finite samples is considered. The boundary integral method is used to compute the space distribution of the magnetic field in rectangular samples. On the basis of these calculations we compute the distribution of demagnetization factors in the sample for μSR experimental set-up with the real field geometry. The corresponding mathematical expectation and dispersion of this distribution are estimated. The results of the calculation are used in the analysis of the μSR data obtained for high T_c superconductors. It is shown for these compounds that the correction to the penetration depth related to the broadening of the field distribution, is not more than 5%. 8 refs.; 2 figs.; 1 tab.

2160 (JINR-R-3-91-392) **Slow neutron scattering on ThO_2 and UO_2.** Kozlov, Zh.A. (Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Neutron Physics); Semenov, V.A.; Padureanu, I.; Rapeanu, S.; Rotaresku, G. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Neutron Physics. 1991. 15p. (In Russian). Order Number DE93606306. Source: OSTI; NTIS (US Sales Only); INIS.

The results of the inelastic neutron scattering experiments on ThO_2 and UO_2 are presented. The frequency spectrum $g(\hbar w)$ for ThO_2 and UO_2 at room temperature is obtained. The function $g(\hbar w)$ for ThO_2 is obtained also at temperatures T=778 K and 1278 K. The experiments were performed on the spectrometer DIN-2pi at the IBR-2 reactor. 30 refs.; 13 figs.; 1 tab.

2161 (JINR-R-14-91-94) **Investigation of Y-Ba-Cu-O films using backscattering of $^4He^+$ Ions.** Kobzev, A.P. (and others); Machajdik, D.; Sandrik, R. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems. 1991. 12p. (In Russian). Order Number DE93606305. Source: OSTI; NTIS (US Sales Only); INIS.

Backscattering spectra of Y-Ba-Cu-O films using $^4He^+$ -ions beam were investigated at the angle 171 deg. It was shown that the backscattering analysis is suitable to determine film thickness, elemental composition, depth distribution for all elements in the film as well as interaction between film and substratum. 9 refs.; 10 figs.

6653 Interactions Between Beams and Condensed Matter

Refer also to citation(s) 1037, 1054, 1338

2162 (ANL/CP-77000) **C_{60} interactions with surfaces, gaseous species and photons: An overview.** Gruen, D.M. Argonne National Lab., IL (United States). [1992]. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-920945-1: Workshop on inelastic ion surface collisions, Aussois (France), 14-18 Sep 1992). Order Number DE92040738. Source: OSTI; NTIS; INIS; GPO Dep.

The behavior of C_{60} in collisions with surfaces, with other gaseous species, and with photons is discussed. The focus is on the processes leading to fragmentation of the molecule, the identification of fragmentation products, and the mechanism of fragmentation. The nature of the fragmentation process of C_{60} is of considerable interest in itself and needs to be understood in detail if C_{60} cluster ion beams are to be fully exploited technologically. In addition, one may anticipate that an understanding of C_{60} fragmentation will contribute mutatis mutandis to an elucidation of the elementary steps leading to the assembly of C_{60} from smaller carbon clusters.

2163 (CONF-9206275-2) **Above-surface neutralization of highly charged ions: The formation of hollow atoms.** Burgdoerfer, J. (Tennessee Univ., Knoxville, TN (United States). Dept. of Physics); Meyer, F. Oak Ridge National Lab., TN (United States). [1992]. 22p. Sponsored by USDOE, Washington, DC (United States); National Science Foundation, Washington, DC (United States). DOE Contract AC05-84OR21400. From Nobel symposium on heavy ion spectroscopy and QED effects in atomic systems; Saltsjoebaden (Sweden); 29 Jun - 3 jul 1992. Order Number DE93001371. Source: OSTI; NTIS; INIS; GPO Dep.

We investigate the interaction of multiply charged ions with metallic surfaces. Simulations are presented displaying the formation of hollow atoms when slow highly charged ions approach the surface. It is shown that above surface neutralization proceeds via hollow-atom formation. Relaxation of the multiply excited states to the ground state occurs only subsequent to the close encounter with the topmost atomic layer. Recent experimental data on K Auger emission and image acceleration confirm this scenario.

2164 (DOE/ER/14224-1) **Atomic probes of surface structure and dynamics: Technical progress report, September 15, 1992–September 14, 1993.** Heller, E.J.; Jonsson, H. Washington Univ., Seattle, WA (United States). Dept. of Chemistry. [1992]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG06-91ER14224. Order Number DE92040066. Source: OSTI; NTIS; INIS; GPO Dep.

Progress for the period Sept. 15, 1992 to Sept. 14, 1993 is discussed. Semiclassical methods that will allow much faster and more accurate three-dimensional atom–surface scattering calculations, both elastic and inelastic, are being developed. The scattering of He atoms from buckyballs is being investigated as a test problem. Somewhat more detail is given on studies of He atom scattering from defective Pt surfaces. Molecular dynamics simulations of He^+ and Ar^+ ion sputtering of Pt surfaces are also being done. He atom scattering from Xe overlayers on metal surfaces and the thermalized dissociation of H_2 on Cu(110) are being studied. (R.W.R.) 64 refs.

2165 (INIS-BR-2933, pp. 221) **Effects of ion implantation on superficial microstructure and hydrogen permeability in low-alloy high strength steel.** Zampronio, M.A. (Universidade Federal, Rio de Janeiro, RJ (Brazil). Coordenacao dos Programas de Pos-graduacao de Engenharia); Fassini, F.D.; Miranda, P.E.V.; Pivin, J.C. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. LOW ALLOY STEELS/ion implantation; CARBON 12 BEAMS; HYDROGEN; MICROSTRUCTURE; PERMEABILITY; POLARIZATION; TITANIUM 48 BEAMS; TRANSMISSION ELECTRON MICROSCOPY

2166 (INIS-BR-2933, pp. 228) **Obtainment and characterization of amorphous NiP by ion implantation.** Miranda, R.M. (Rio Grande do Sul Univ., Porto Alegre, RS (Brazil). Inst. de Fisica); Pureur, P.; Amaral, L.; Baibich, M.N. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

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PHOSPHORUS; TEMPERATURE DEPENDENCE; TEMPERATURE RANGE 0065-0273 K; X-RAY DIFFRACTION

2167 (INIS-BR–2933, pp. 229) **On simultaneous occurrence of distinguished electric resistivity phases during Ion bombardment of NiAl alloy.** Costa, J.A.B. da (Santa Maria Univ., RS (Brazil). Dept. de Fisica); Vasconcellos, M.A.Z.; Teixeira, S.R.; Baibich, M.N.; Scherer, C. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

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2168 (INIS-BR–2933, pp. 229) **Phase formation kinetics in structures of thin films submitted to Ion bombardment.** Garcia, V.H. (Santa Catarina Univ., Florianopolis, SC (Brazil). Dept. de Fisica); Costa, J.A.B. da; Scherer, C. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. THIN FILMS/ion implantation; ION BEAMS; MONTE CARLO METHOD; PHASE TRANSFORMATIONS; TRAJECTORIES

2169 (INIS-BR–2933, pp. 238) **Diffusion and formation of phases in irradiated metallic systems.** Dajello, P.C.T. (Santa Catarina Univ., Florianopolis, SC (Brazil). Dept. de Fisica); Lauck, S. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

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2170 (INIS-BR–2933, pp. 253) **Bombardment of semiconductors with He^{+3}.** Boskovic, A. (Pontificia Univ. Catolica do Rio de Janeiro, RJ (Brazil). Dept. de Fisica); Margulis, W. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. SEMICONDUCTOR MATERIALS/helium ions; CRYSTAL DEFECTS; GALLIUM ARSENIDES; INDIUM PHOSPHIDES; ION BEAMS; IRRADIATION; LASER RADIATION; MEV RANGE 01-10; PHOTOCONDUCTORS

2171 (INIS-BR–2933, pp. 255) **Ascendent conversion of frequencies in optical fibers doped with rare earth ions.** Moraes, E.S. (Pernambuco Univ., Recife, PE (Brazil). Dept. de Fisica); Gomes, A.S.L.; Araujo, C.B. de. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. ION BEAMS/doped materials; AMPLIFICATION; ENERGY TRANSFER; ERBIUM IONS; EXCITATION; OPTICAL FIBERS; PRASEODYMIUM IONS; SPECTROSCOPY; SUPERRADIANCE

2172 (INIS-BR–2933, pp. 284) **Study on diffusion of Xe implanted in polymer film at low temperature.** Kaschny, J. (Rio Grande do Sul Univ., Porto Alegre, RS (Brazil). Inst. de Fisica); Bhear, M; Amaral, L. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. XENON/ion implantation; ACTIVATION ENERGY; ANNEALING; DIFFUSION; FILMS; POLYMERS; TEMPERATURE RANGE 0065-0273 K; XENON

2173 (INIS-BR–2933, pp. 324) **Physico-chemical processes induced by ionizing radiation and dynamics of defects in MOS structures.** Silva Junior, E.F da (Pernambuco Univ., Recife, PE (Brazil). Dept. de Fisica). Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

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2174 (INIS-BR–2933, pp. 333) **Effects of nitrogen doping in a-Ge:H.** Zanatta, A.R. (Universidade Estadual de Campinas, SP (Brazil). Inst. de Fisica); Chambouleyron, I. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

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2175 (INIS-BR–2933, pp. 340) **Influence of Fe^{56} on epitaxy recrystallization of Si in substrates <100> and <111>.** Paula, D. de; Amaral, L.; Souza, J.P. de. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. IRON 56/epitaxy; SILICON/recrystallization; AMORPHOUS STATE; ANNEALING; GERMANIUM 74; ION IMPLANTATION; EPITAXY; RUTHERFORD SCATTERING; SILICON; RECRYSTALLIZATION; SUBSTRATES; TEMPERATURE RANGE 0400-1000 K

2176 (INIS-BR–2933, pp. 349) **Irradiation of $TlBa_2CaCu_2O_x$ monocrystals by heavy ions.** Tessler, L.R. (Centre des Materiaux Supraconducteurs, CRISMAT, Caen Cedex (France)); Hardy, V.; Groult, D.; Provost, J.; Raveau, B. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

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2177 (INIS-BR–2933, pp. 356) **Zinc doping effect on YBaCuO.** Delben, J.R.J. (Mato Grosso do Sul Univ., Campo Grande, MS (Brazil). Dept. de Fisica); Basso, H.C. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

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2178 (INIS-BR–2933, pp. 364) **Agglomeration depth distribution of damages induced by ion bombardment investigated by in-situ electric resistivity measurements.** Vasconcellos, M.A.Z. (Rio Grande do Sul Univ., Porto Alegre, RS (Brazil). Inst. de Fisica); Teixeira, S.R.; Scherer, C.; Baibich, M.N.; Costa, J.A.B. da. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

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2179 (INIS-BR–2933, pp. 364) **Effects ox oxygen and nitrogen implantation on $Cu_3Al(100)$ alloy structure using low energy ion scattering.** Achete, C. (Universidade Federal, Rio de Janeiro, RJ (Brazil)); Niehus, H. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. ION IMPLANTATION/alloy systems; AUGER ELECTRON SPECTROSCOPY; COPPER; CRYSTAL STRUCTURE; ELECTRON DIFFRACTION; GOLD; HEAT TREATMENTS; KEV RANGE 01-10; NITROGEN IONS; OXYGEN IONS; STRUCTURAL CHEMICAL ANALYSIS; TEMPERATURE RANGE 0400-1000 K

2180 (INIS-BR–2933, pp. 365) **Ion implantation in Naβ''-alumina.** Freire Junior, F.L. (Pontificia Univ. Catolica do Rio de Janeiro, RJ (Brazil). Dept. de Fisica). Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. CRYSTALS/ion implantation; ALUMINIUM OXIDES; CHEMICAL PROPERTIES; CRYSTALS; CURRENT DENSITY; DIFFUSION; ELECTRIC FIELDS; ENERGY DEPENDENCE; OPTICAL PROPERTIES; RADIATION DOSES; SODIUM

2181 (INIS-BR–2933, pp. 365) **Desorption of Ions by atomic and molecular projectiles with energies from 300 KeV to 3 MeV.** Pinho, R.R. (Pontificia Univ. Catolica do Rio de Janeiro, RJ (Brazil). Dept. de Fisica); Silveira, E.F. da; Leite, C.V.B.; Jeronymo, J.M.F.; Baptista, G.B.; Ponciano, C.R.; Goncalves, A.C.M. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. ATOMIC BEAMS/phenylalanine; MOLECULAR BEAMS/phenylalanine; PHENYLALANINE; DESORPTION; IRRADIATION; KEV RANGE 100-1000; MEV RANGE 01-10; STOPPING POWER; VAN DE GRAAFF ACCELERATORS

2182 (INIS-BR–2933, pp. 365) **Study on magnetic behaviour in Fe/Nd multilayers.** Pereira, L.G. (Rio Grande do Sul Univ., Porto Alegre, RS (Brazil). Inst. de Fisica); Teixeira, S.R.; Schreiner, W.H.; Baumvol, I.J.R.; Missel, F.P. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. ION IMPLANTATION/thin films; ANNEALING; BORON; IRON; LAYERS; MAGNETIC PROPERTIES; NEODYMIUM; PHASE TRANSFORMATIONS

2183 (INIS-BR–2933, pp. 379) **Electron emission by ion project-surface interaction.** Santos, F.P. (Pontificia Univ. Catolica do Rio de Janeiro, RJ (Brazil). Dept. de Fisica); Matos, M.; Silveira, E.F. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. ELECTRON EMISSION/ion implantation; CHARGE STATES; ELECTRIC POTENTIAL; SURFACES; TIME DEPENDENCE; TUNNEL EFFECT; WKB APPROXIMATION

2184 (INIS-BR–2933, pp. 379) **Study cn desorption using time-of-flight technique.** Silveira, E.F. da (Pontificia Univ. Catolica do Rio de Janeiro, RJ (Brazil)); Leite Filho, C.V.; Pereira, J.A. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. DESORPTION/time-of-flight method; ANGULAR DISTRIBUTION; CALIFORNIUM 252; DESORPTION; FISSION FRAGMENTS; ION IMPLANTATION; KINETIC ENERGY

2185 (IYaF–91-111) **Hard photon emission from high energy electrons and positrons in single crystals.** Bajer, V.N.; Katkov, V.M.; Strakhovenko, V.M. AN SSSR, Novosibirsk (Russian Federation). Inst. Yadernoj Fiziki. 1991. 31p. Order Number DE93606328. Source: OSTI; NTIS (US Sales Only); INIS.

A radiation of electrons and positrons in single crystals in coherent bremsstrahlung (CBS) region has been considered for the case when CBS has the most hard spectrum. Under this condition a particle moves near a crystalline plane (in fcc(d) crystal for axis (001) this is the plane (110)) and influence of the continuous plane potential should be taken into account. This potential gives additional contribution in soft part of the spectrum and affects on hard photon emission. Observation of this phenomena at high energy is discussed. 14 refs.; 5 figs.; 1 tab.

2186 (JINR-R–2-91-333) **Heat generation produced in thin layers of GaAs superconductors under high energy particles irradiation.** Barashenkov, V.S. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation); Sosnin, A.N.; Shmakov, S.Yu.; Polanski, A. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Computing Techniques and Automation. 1991. 3p. (In Russian). Order Number DE93606332. Source: OSTI; NTIS (US Sales Only); INIS.

Monte Carlo simulation of heat generation spectra in thin (50-100 μm) layers of GasAs is carried out basing on interactions of protons and ^{12}C ions at 3.65 GeV/c. These calculated results are compared to those for silicon. The most important from the point of view of radiation damages of semiconductor devices, is mainly determined by macroscopic cross-section and the spectrum is weakly dependent on the type of bombarding particle and composition of the target. 2 refs.; 3 figs.

2187 (JINR-R–13-91-158) **Energy spectra and photoelectron work function from $YBa_2Cu_3O_7$ high-T_c superconductor.** Matora, I.M. (and others); Bogdzel', A.A.; Zhuravlev, V.V. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Neutron Physics. 1991. 10p. (In Russian). Order Number DE93606329. Source: OSTI; NTIS (US Sales Only); INIS.

The results are presented of the experiments on the JINR newly built instrument for the photoelectron spectroscopy by the time-of-flight method. The energy resolution achieved was (0.2-0.05 eV). The electron work function ϕ from three samples of polycrystalline high-T_c superconductor $YBa_2Cu_3O_7$ have ben masured to be $\phi=(5.5\pm0.2)$ eV. Spectra of photoelectrons in dependence on time and energy are given. 4 refs.; 5 figs.

2188 (JINR-R–13-91-313) **Alpha-particle backscattering from an iron plate surface ($0.5\ MeV<E_\alpha<C_{barrier}$).** Kuznetsova,

M.Ya.; Chumin, V.G. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems. 1991. 19p. (In Russian). Order Number DE93606330. Source: OSTI; NTIS (US Sales Only); INIS.

Probability of alpha-particle backscattering from an iron plate surface, energies and angular distributions of backscattering particles are obtained through the Monte-Carlo method. The plates thickness was taken greater than the mean free path of particles. The calculations are performed for alpha-particles with initial energies 3.0, 4.5 and 6.0 MeV and incident on the iron plate surface at the angles 0.5, 2.5 and 5.0 degrees. The data are compared with the results of analytical calculations by the equation from the literature. The purpose of this work is to obtain data fro estimating influence of backscattering of alpha-particles from the walls and the parts of the spectrometer vacuum chamber on the shape of experimental spectra. 11 refs.; 6 figs.; 2 tabs.

2189 (JINR-R–14-90-352) **Damage produced by swift heavy ions in monocrystalline tungsten.** Bugrov, V.N.; Karamyan, S.A. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Reactions. 1990. 12p. (In Russian). Order Number DE93606331. Source: OSTI; NTIS (US Sales Only); INIS.

Submitted to Fiz. Khim. Obrab. Mater.

The damage of monocrystalline tungsten produced by heavy ions up to Xe at energy from 0.6 to 8.0 MeV/a.m.u. is studied. The direct crystallographic method based on the crystal-blocking effect is applied. The scaling of the dose dependences of the damage for different ions is observed. The variation of the ion damaging power corresponds to the model of the defects generation as a result of nuclear scattering. The contribution of ions electronic energy losses to the tungsten damage is not found. 20 refs.; 3 figs.; 1 tab.

2190 (LA-UR–92-3126) **Chaotic dynamics in the Maxwell-Bloch equations.** Holm, D.D. (Los Alamos National Lab., NM (United States)); Kovacic, G. Los Alamos National Lab., NM (United States). 6 Mar 1992. 28p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-9002140–2: Chaos down under, Sydney (Australia), Feb 1990). Order Number DE93000854. Source: OSTI; NTIS; INIS; GPO Dep.

In the slowly varying envelope approximation and the rotating wave approximation for the Maxwell-Bloch equations, we describe how the presence of a small-amplitude probe laser in an excited, two-level, resonant medium leads to homoclinic chaos in the laser-matter dynamics. We also describe a derivation of the Maxwell-Bloch equations from an action principle.

2191 (NIIEFA-P-D–0826) **Investigation of silicon dioxide buried layers by ion Rutherford backscattering.** Bortnyanskij, A.L.; Klopenkov, M.L.; Pavlovets, M.V.; Shemilinin, S.G. Nauchno-Issledovatel'skij Inst. Ehlektrofizicheskoj Apparatury, Leningrad (Russian Federation). 1989. 6p. (In Russian). Order Number DE93606333. Source: OSTI; NTIS (US Sales Only); INIS.

Methods for investigation into $Si/SiO_2/Si$ type structures by ion Rutherford backscattering method are described. The methods are tested on silicon plates with an oxide film on the surface, covered by a pure silicon layer. The results obtained show that the given methods allow one to realize the limiting capabilities of the method. 7 refs.; 4 figs.

2192 (WIS-PH–92-28) **Monte-Carlo simulations of secondary electron emission from CsI, induced by 1-10 keV X-rays and electrons.** Akkerman, A.; Gibrekhterman, A.; Breskin, A.; Chechik, R. Weizmann Inst. of Science, Rehovoth (Israel). May 1992. 19p. Order Number DE93604906. Source: OSTI; NTIS (US Sales Only); INIS.

A model for electron transport and emission in CsI is proposed. It is based on theoretically calculated microscopic cross-sections for electron interaction with the nuclear and the electronic components of the solid. A Monte Carlo program based on this model was developed to simulate secondary electron emission induced by X-rays and electrons in the energy range of 1 to 10 keV. The calculated secondary emission yields agree with existing experimental data. The model provides all necessary characteristics for the design of radiation detectors based on secondary electron emission. It can be expanded to higher incident energies and other alkali halides. (author).

6654 Quantum Physics Aspects of Condensed Matter

2193 (INIS-mf–13358, pp. 64) **Phase diagram of the antiferromagnetic Heisenberg model with a Dzyaloshinsky-Moriya interaction in a magnetic field at zero temperature.** Yaish, Yuval (Tel Aviv Univ. (Israel). Sackler Faculty of Exact Sciences); Aharony, Amnon. Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Physics. 1992. 169p. (CONF-9204195–: 1992 Israel Physical Society annual meeting, Rehovot (Israel), 15 Apr 1992). In *Israel physical society 1992 annual meeting: Program and abstracts.* Order Number DE93604079. Source: OSTI; NTIS (US Sales Only); INIS.

Abstract only. HEISENBERG MODEL/magnetic fields; ANTIFERROMAGNETISM; PHASE DIAGRAMS

665410 Superconductivity

Refer also to citation(s) 736, 737, 1029, 1035, 1076, 1127, 1285, 2087

2194 (ANL/CP–77115) **Domain decomposition: A blowup problem and the Ginzburg–Landu equations.** Kwong, Man Kam. Argonne National Lab., IL (United States). [1992]. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9209217–1: NATO workshop on numerical methods for partial differential equations and critical parameters, Beaune (France), 25-28 Sep 1992). Order Number DE92040736. Source: OSTI; NTIS; GPO Dep.

In two of our recent projects, the technique of domain decomposition plays a crucial role in the numerical integration of the partial differential equations. In our problems, the local behavior varies because of the nonlinear and singular nature of the equations. Attempts to introduce different length scales did not lead to improvement. We found that different form of the equations have to be used over different subdomains. The first project arises in an effort to determine the profile at the moment of blowup or quenching of a nonlinear heat equation. The second project arises in the investigation of the Ginzburg-Landau equation in the theory of superconductivity.

2195 (ANL/CP–77139) **Fabrication and properties of high-$T_c$tapes and coils made from silver-clad Bi-2223 superconductors.** Haldar, P. (Intermagnetics General Corp., Guilderland, NY (United States)); Hoehn, J.G. Jr.; Rice, J.A.; Motowidlo, L.R.; Balachandran, U.; Youngdahl, C.A.; Tkaczyk, J.E.; Bednarczyk, P.J. Argonne National Lab., IL (United States). Aug 1992. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-920802–13: Applied superconductivity conference, Chicago, IL (United States), 23-28 Aug 1992). Order Number DE92040760. Source: OSTI; NTIS; GPO Dep.

Long lengths of flexible silver-clad Bi-2223 high-$T_c$superconductors have been fabricated by the powder-in-tube. technique. By improving process conditions dc transport measurements at liquid helium (4.2K) and hydrogen (20K) temperatures yield J_c's greater than 10^5 A/cm^2 at zero field and exceed 3×10^4 A/cm^2 at liquid nitrogen (77K) temperature in short tape samples. Detailed microstructural analysis and J_c measurements with applied fields up to 20 T are reported. Coils have been fabricated from 1 meter lengths of conductor with J_c's at 77K approaching 10^4 A/cm^2. Measurements on small pancake coils made from 10 meter tapes are also reported.

2196 (ANL/CP–77443) **Design and test of a superconducting structure for high-velocity ions.** Delayen, J.R.; Kennedy, W.L.; Roche, C.T. Argonne National Lab., IL (United States). [1992]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9208109–64: 16. international LINAC conference, Ottawa (Canada), 23-28 Aug 1992). Order Number DE93000513. Source: OSTI; NTIS; INIS; GPO Dep.

Following the successful development of a niobium coaxial half-wave structure we have designed, built and tested a new half-wave geometry: the spoke resonator. This geometry is better suited for

high frequency resonators and for the acceleration of high velocity ions. The prototype cavity is a 2-gap structure resonating at 855 MHz, and optimized for particle velocity of 0.30 c. It is easier to manufacture than the coaxial half-wave resonator and the geometry can be straightforwardly extended to multigap designs. Rf-tests have been performed on this cavity both prior to and after high temperature annealing. An accelerating gradient of 7.2 MV/m (cw) and 7.8 MV/m (pulsed) was observed at 4.2 K. After annealing, a low power Q_0 of 1.2 $\times 10^8$ was observed with small Q degradation due to field emission at high accelerating fields.

2197 (BNL–47325) **Concerning factors which determine whether flux-lattice shear or pin breaking limits the critical current density of superconductors.** Welch, D.O. Brookhaven National Lab., Upton, NY (United States). [1992]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-920802–23: Applied superconductivity conference, Chicago, IL (United States), 23-28 Aug 1992). Order Number DE93001653. Source: OSTI; NTIS; INIS; GPO Dep.

An elementary model is presented which illustrates the conditions under which flux-lattice shear, rather than pin breaking, limits the critical current density. An expression for the shear strength of the flux-lattice, based on the plasticity of metals and alloys, is used to derive the critical current density, including the effect of thermal activation in the flux creep regime.

2198 (CEA-CONF–10984) **Application of superconductivity for large equipments in physics.** Kircher, F. CEA Centre d'Etudes de Saclay, 91 - Gif-sur-Yvette (France). Dept. d'Astrophysique, de la Physique des Particules, de la Physique Nucleaire et de l'Instrumentation Associee. 1992. 8p. (In French). (CONF-9203199–: Meeting on Technology, Paris (France), 24-25 Mar 1992). Order Number DE93721047. Source: OSTI; NTIS (US Sales Only); INIS.

Performance and applications of superconducting cavities and superconducting magnets, using liquid or superfluid helium, are reviewed.

2199 (CEA-CONF–10986) **Conceptual design of the CMS 4 Tesla solenoid.** Baze, J.M.; Desportes, H.; Duthil, R.; Lesmond, C.; Lottin, J.C.; Pabot, Y. CEA Centre d'Etudes de Saclay, 91 - Gif-sur-Yvette (France). Dept. d'Astrophysique, de la Physique des Particules, de la Physique Nucleaire et de l'Instrumentation Associee. Feb 1992. 15p. (CONF-9203195–: Proceedings of the General Meeting on LHC Physics and Detectors, Evian (France), 5-8 Mar 1992). Order Number DE93721048. Source: OSTI; NTIS (US Sales Only); INIS.

A large and important meeting 'Toward the LHC experimental programme' is due to be held at EVIAN-les-BAINS, on 5-8 March 1992. The major goal accurate measurement of muon momenta makes necessary, for the detectors, the use of large and powerful magnetic system producing high bending power. The CMS experiment is based on a solenoidal magnetic configuration. It has been designed to produce a high magnetic induction (4 T) in a 14 m long, 5.9 m bore cylindrical volume surrounding the interaction point. The diameter has been fixed to the maximum dimension compatible with road transportation to CERN. This long solenoid with its 12 500 ton iron yoke is a fully shielded magnet. The paper presents the conceptual design of the superconducting coil and its technical characteristics.

2200 (CEA-CONF–10987) **New devices for the magnetic center location of quadrupole magnets.** Le Bars, J.; Kircher, F. CEA Centre d'Etudes de Saclay, 91 - Gif-sur-Yvette (France). Dept. d'Astrophysique, de la Physique des Particules, de la Physique Nucleaire et de l'Instrumentation Associee. Mar 1992. 3p. (CONF-920315–: 3. European particle accelerator conference, Berlin (Germany), 24-28 Mar 1992). Order Number DE93721049. Source: OSTI; NTIS (US Sales Only); INIS.

A system is presently under development at SACLAY for determining the location of the magnetic center of superconducting quadrupole magnets. It uses magnetic crystals in garnet film form, with visualization of the results by an optical method. This paper will describe the sensors, the measuring methods and the results which have been obtained so far, they are quite encouraging for long superconducting quadrupoles, for which the classical mechanical methods have reached their limits.

2201 (CONF-920802–14) **Investigating thermal hydraulic quenchback in a cable-in-conduit superconductor.** Lue, J.W.; Dresner, L.; Schwenterly, S.W.; Wilson, C.T.; Lubell, M.S. Oak Ridge National Lab., TN (United States). [1992]. 4p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract AC05-84OR21400. From Applied superconductivity conference; Chicago, IL (United States); 23-28 Aug 1992. Order Number DE92040864. Source: OSTI; NTIS; GPO Dep.

Quench propagation of a cable-in-conduit force-cooled superconductor plays a very important role in the protection of a magnet built with such a conductor as in a Superconducting Magnetic Energy Storage (SMES) system. Some thermal analysis showed that the compressional and frictional heating exerted by the expanding hot helium could heat the helium away from the normal zone above the superconductor current sharing temperature. Thus an acceleration of the quench propagation could be realized. This phenomenon was termed thermal hydraulic quenchback (THQ). A setup has been built specifically to investigate this phenomenon. The test sample consists of a 50-m-long NbTi superconducting cable enclosed in a stainless steel conduit. Heaters 0.2 to 8 m long are provided to quench the conductor. This paper reports experimental finding of THQ and its dependence on the initial normal zone length, the conductor current, and the temperature.

2202 (DOE/ER/13335–1) **Cryotribology: Development of cryotribological theories and application to cryogenic devices: Interim report, June 15, 1985–August 31, 1992.** Iwasa, Y. (Massachusetts Inst. of Tech., Cambridge, MA (United States)); Michael, P.; Rabinowicz, E. Massachusetts Inst. of Tech., Cambridge, MA (United States). 15 Sep 1992. 232p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-85ER13335. Order Number DE93000404. Source: OSTI; NTIS; GPO Dep.

High-performance superconducting solenoids are susceptible to premature quenches, or superconducting to normal state transitions, due to abrupt conductor movements within the winding. Abrupt motions involving 5~10μm conductor displacements dissipate sufficient energy to trigger a quench. Sliding and mechanical behaviors of materials at cryogenic temperatures have been experimentally examined. After accounting for changes in the sliding materials' low-temperature strength properties, we have found that the adhesion theory of friction and wear remains applicable at cryogenic temperatures. The adhesion friction theory suggests two methods for controlling unsteady sliding motions. The first involves the selection of sliding materials whose friction coefficients increase with increasing sliding speed. A number of material pairs have been examined for positive friction-velocity characteristics. This materials-based approach to frictional stabilization does not seem a viable option at 4.2 K. The second alternative is to preprogram the force conditions within high-risk regions of the winding to regulate the occurrence of unsteady sliding motions. Structural models are proposed to account for unsteady conductor motions on a variety of dimensional scales. The models are used to design a small superconducting solenoid. Performance of this solenoid suggests that force-based motion control is a potentially viable design approach for achieving successful dry-wound magnets.

2203 (DOE/ER/13846–5) **Mathematical models of hysteresis: Progress report, January 1992–December 1992.** Mayergoyz, I.D. Maryland Univ., College Park, MD (United States). Dept. of Electrical Engineering. Sep 1992. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-88ER13846. Order Number DE93001837. Source: OSTI; NTIS; GPO Dep.

This report discusses the mathematical models of the hysteresis of magnet materials and superconducting materials. (LSP)

2204 (INIS-BR–2933, pp. 358) **Prototype of superconducting magnet for magnetohydrodynamic energy generator.** Santos Filho, V. dos (Fundacao de Tecnologia Industrial (FTI), Lorena, SP (brazil). Centro de Materiais Refratarios); Shigue, C.Y. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter*

Physics. v.2. Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. MHD GENERATORS/ superconducting magnets; SUPERCONDUCTING MAGNETS; MAGNETIC FIELDS

2205 (INIS-BR–2933, pp. 345) **Effect of CuO substitution by NiS on $YBa_2Cu_3O_{7-\delta}$ superconductivity.** Albino Aguiar, J. (Pernambuco Univ., Recife, PE (Brazil). Dept. de Fisica); Ferreira, J.M.; Melo, M.T. de; Schettini, C.; Schneider, F.; Barbosa, M.V.S.; Pavao, A.C. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. SUPERCONDUCTORS/ superconductivity; BARIUM; CRITICAL TEMPERATURE; CUPRATES; SULFUR NITRIDES; SUPERCONDUCTORS; SUPERCONDUCTIVITY; YTTRIUM

2206 (INIS-BR–2933, pp. 345) **Effects of uniaxial symmetry in the supercurrent distribution surrounding the vortex in the London approximation.** Buisson, O. (Pontificia Univ. Catolica do Rio de Janeiro, RJ (Brazil). Dept. de Fisica); Doria, M.M. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. SUPERCONDUCTORS/london equation; SUPERCONDUCTORS; SYMMETRY

2207 (INIS-BR–2933, pp. 346) **Fast convergent free energy expansion for uniaxial superconductors in the London approximation.** Doria, M.M. (Pontificia Univ. Catolica do Rio de Janeiro, RJ (Brazil). Dept. de Fisica). Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. SUPERCONDUCTORS/london equation; CRITICAL FIELD; FREE ENERGY; SUPERCONDUCTORS

2208 (INIS-BR–2933, pp. 346) **Superconductivity and antiferromagnetism in extended Hubbard model.** Lara, G.A. (Universidade Estadual de Campinas, SP (Brazil). Inst. de Fisica); Cabrera, G.G. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. CRYSTAL MODELS/ antiferromagnetism; CRYSTAL MODELS/superconductivity; COPPER OXIDES; COULOMB FIELD; ANTIFERROMAGNETISM; SUPERCONDUCTIVITY

2209 (INIS-BR–2933, pp. 347) **The superconductivity research in Brazil.** Lima, O.F. de (Universidade Estadual de Campinas, SP (Brazil). Inst. de Fisica). Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. SUPERCONDUCTIVITY/brazil; RESEARCH PROGRAMS; SUPERCONDUCTIVITY; BRAZIL

2210 (INIS-BR–2933, pp. 348) **Effects of aging and granulometry on oxygen content and on superconducting transition of $YBa_2Cu_3O\text{-}7_{-\delta}$.** Campos, S.P. de (Universidade Estadual de Campinas, SP (Brazil). Inst. de Fisica); Andrade Junior, R. de; Avila, M.A.; Lima, O.F. de. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. SUPERCONDUCTIVITY/aging; BARIUM; COPPER OXIDES; GRAIN SIZE; OXYGEN; SUPERCONDUCTIVITY; AGING; SUPERCONDUCTORS; YTTRIUM

2211 (INIS-BR–2933, pp. 351) **Superconductivity and spin-polaron pair model.** Mota, R. (Santa Maria Univ., RS (Brazil). Dept. de Fisica); Lima, G.A.R.; Fazzio, A. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. PAIRING INTERACTIONS/ superconductivity; SUPERCONDUCTIVITY; POLARONS; SPIN

2212 (INIS-BR–2933, pp. 351) **Superconductivity in two-band systems: application to transition metals and high-T_c materials.** Japiassu, G.M. (Universidade Federal, Rio de Janeiro, RJ (Brazil)); Continentino, M.A.; Troper, A. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. SUPERCONDUCTIVITY/ transition elements; BCS THEORY; CRITICAL TEMPERATURE; EQUATIONS OF MOTION; HYBRIDIZATION; IRREVERSIBLE PROCESSES; MANY-BODY PROBLEM; ORDER PARAMETERS; QUASI PARTICLES; SUPERCONDUCTIVITY; SUPERCONDUCTORS

2213 (INIS-BR–2933, pp. 348) **MBE of high T_c superconducting oxides: a personnel point of view.** Tessler, L.R. (Ecole Superieure de Physique et Chimie Industrielles, 75 - Paris (France). Lab. de Physique Quantique). Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. SUPERCONDUCTORS/sample preparation; ANNEALING; CRITICAL TEMPERATURE; MOLECULAR BEAMS; OXIDES; SUPERCONDUCTORS; THIN FILMS

2214 (INIS-BR–2933, pp. 355) **Study on formation kinetic of isostructural Bi-Sr-Co-O compounds to Bi-Sr-Ca-Cu-O high T_c superconductors.** Suzuki, P.A. (Sao Paulo Univ., SP (Brazil). Inst. de Fisica); Fantini, M.C.A.; Jardim, R.F. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. SUPERCONDUCTING COMPOSITES/critical temperature; BISMUTH; CALCIUM; COBALT; COPPER OXIDES; DIFFERENTIAL THERMAL ANALYSIS; ELECTRIC CONDUCTIVITY; MONOCRYSTALS; PHASE STUDIES; STOICHIOMETRY; STRONTIUM; SUPERLATTICES; X-RAY DIFFRACTION

2215 (INIS-BR–2933, pp. 357) **Measurements of AC electric resistivity in $Y_1Ba_2Cu_3O_{7-x}$ thick films.** Coelho, A.L. (Instituto de Pesquisas Energeticas e Nucleares (IPEN), Sao Paulo, SP (Brazil)); Leme, D.G.; Morato, S.P. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. SUPERCONDUCTING FILMS/ electric conductivity; BARIUM; COPPER OXIDES; SUBSTRATES; TEMPERATURE RANGE 0065-0273 K; YTTRIUM

2216 (INIS-BR–2933, pp. 352) **Effect of air-tightness in superconducting junctions.** Lyra, M.L. (Alagoas Univ., Maceio, AL (Brazil). Dept. de Fisica); Bastos Filho, J.B. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. SUPERCONDUCTING JUNCTIONS/josephson effect; COOPER PAIRS; FLIP-FLOP CIRCUITS; HAMILTONIANS; TUNNEL EFFECT

2217 (INIS-BR–2934, pp. 73-90) **Field theoretical description of high-Tc superconductors: topological excitations, generalized statistics and doping.** Marino, E.C. (Pontificia Univ. Catolica do Rio de Janeiro, RJ (Brazil). Dept. de Fisica). Sociedade Brasileira de Fisica, Rio de Janeiro, RJ (Brazil). 1989. 350p. (CONF-8909489–: 10. National Meeting on Physics of Particles and Fields, Itatiaia (Brazil), 20-24 Sep 1989). In *Proceedings of the 10. National Meeting on Physics of Particles and Fields.* Order Number DE93604123. Source: OSTI; NTIS (US Sales Only); INIS.

We describe the continuum field-theoretical formulation for the new superconductors. The aspects related with topological excitations and generalized statistics are emphasized. A tentative description of doping is made and and a possible mechanism of superconductivity is conjectured. (author).

2218 (INIS-mf–13358, pp. 11) **Review on high-temperature superconductors: Oxides and Fullerenes.** Yeshurun, Y. (Bar-Ilan Univ., Ramat-Gan (Israel). Dept. of Physics). Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Physics. 1992. 169p. (CONF-9204195–: 1992 Israel Physical Society annual meeting, Rehovot (Israel), 15 Apr 1992). In *Israel physical society 1992 annual meeting: Program and abstracts.* Order Number DE93604079. Source: OSTI; NTIS (US Sales Only); INIS.

Abstract only. HIGH-TC SUPERCONDUCTORS/magnetic properties

2219 (INIS-mf–13358, pp. 22) **Magnetic properties of electron liquids with disorder.** Finkelstein, A. (AN SSSR, Moscow (Russian Federation). Inst. Teoreticheskoj Fiziki). Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Physics. 1992. 169p. (CONF-9204195–: 1992 Israel Physical Society annual meeting, Rehovot (Israel), 15 Apr 1992). In *Israel physical society 1992 annual meeting: Program and abstracts.* Order Number DE93604079. Source: OSTI; NTIS (US Sales Only); INIS.

Abstract only. HIGH-TC SUPERCONDUCTORS/magnetic properties; COPPER IONS; PHASE TRANSFORMATIONS; SUPERCONDUCTORS

2220 (INIS-mf–13358, pp. 51) **Multivortex states in large pinnig centers.** Khalfin, I.B. (Bar-Ilan Univ., Ramat-Gan (Israel). Dept. of Physics); Sapiro, Y.B. Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Physics. 1992. 169p. (CONF-9204195–: 1992 Israel Physical Society annual meeting, Rehovot (Israel), 15 Apr 1992). In *Israel physical society 1992 annual meeting: Program and abstracts.* Order Number DE93604079. Source: OSTI; NTIS (US Sales Only); INIS.

Abstract only. SUPERCONDUCTIVITY/magnetic flux; ABRIKOSOV THEORY; SUPERCONDUCTIVITY

2221 (IYaF–91-101) **On the ground state structure of two-dimensional Hubbard model on square lattice. Quantum melting of the Neel ordering.** Sushkov, O.P. AN SSSR, Novosibirsk (Russian Federation). Inst. Yadernoj Fiziki. 1991. 16p. Order Number DE93606387. Source: OSTI; NTIS (US Sales Only); INIS.

Two-dimensional t-J model equivalent at $t>J$ to the Hubbard model is considered by the variational method. The compact anzats are proposed for the mobile hole wave function. The dispersion of this holes on the Neel and RVB background is calculated. It is shown that the doping induces transition from the Neel state to the spin-liquid RVB state. At $I\leq t/J\leq 4$ the transition point is at hole concentration $x\approx 0.1$. 22 refs.; 2 tabs.

2222 (JINR-E–3-91-330) **Measurement of magnetic field penetration depth in niobium polycrystalline films by polarized neutron reflection method.** Chernenko, L.P.; Korneev, D.A.; Petrenko, A.V.; Balalykin, N.I.; Skripnik, A.V. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems. 1991. 4p. Order Number DE93606390. Source: OSTI; NTIS (US Sales Only); INIS.

The values of the superconducting penetration depth measured on thin and thick niobium films are presented. The obtained values of s.p.d. in our experiments at T=4.9 K are 145(+/-15) nm for a thin film and 90 (+/-) nm for a thick film. It is essentially different from that one for bulk niobium. 4 refs.; 1 fig.

2223 (JINR-E–14-90-365) **Study of the modulated structure of $Bi_2(Sr,Ca)_3Cu_2O_{8+\gamma}$ in the range 8-920 K.** Beskrovnyj, A.I.; Dlouha, M.; Jirak, Z.; Vratislav, S. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Neutron Physics. 1990. 11p. Order Number DE93606389. Source: OSTI; NTIS (US Sales Only); INIS.

Submitted to Physica B plus C.

The 80 K superconductor $Bi_2(Sr, Ca)_3Cu_2O_{8+\gamma}$ was investigated at room and low temperatures by the single-crystal neutron diffraction and at elevated temperatures by the powder diffraction. The 4.75a modulation and excess of oxygen (γ=0.21 in the ideal case) persist over all the temperature range without marked changes. Complete structural refinement at 90 K and 55 K revealed only small changes with respect to the room-temperature structure. Essentially, the cation-oxygen distances which are considered as bonding are retained while some nonbonding ones decrease. The bonding of copper within the CuO_2 layer remains nearly planar in distinction to the related 93 K superconductor $YBa_2Cu_3O_7$ in which the copper cations are substantially shifted out of the oxygen plane. 7 refs.; 2 figs.; 1 tab.

2224 (JINR-R–4-91-142) **A possibility to investigate the superconducting gap with the help of neutrons.** Ignatovich, V.K.; Lushchikov, V.I. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Neutron Physics. 1991. 8p. (In Russian). Order Number DE93606392. Source: OSTI; NTIS (US Sales Only); INIS.

The neutron scattering on conduction electrons in normal metals and paired electrons in superconductors is theoretically considered. The contribution of conduction electrons of metals to heaving ultracold neutrons is also estimated ($\nu=10^{-12}$). 8 refs.

2225 (JINR-R–14-91-208) **Infrared radiation absorption in superconducting metaloxide $YBa_2Cu_3O_{7-\sigma}$.** Tyutyunnikov, S.I.; Shalyapin, V.N. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of High Energy. 1991. 7p. (In Russian). Order Number DE93606391. Source: OSTI; NTIS (US Sales Only); INIS.

The absorption infrared spectra measurements in superconducting metaoxides $YBa_2Cu_3O_{7-\sigma}$ in the dynamic range wave of 0.25-25 μm are given. The influence of the etching samples on the absorption spectra has been studied. 5 refs.; 5 figs.; 1 tab.

2226 (KAERI/RR–1020/90) **A study on the development of high-Tc superconducting wire.** Won, Dong Yeon (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Lee, Hee Gyoun; Kim, Chan Joong. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Sep 1991. 194p. (In Korean). Order Number DE93606393. Source: OSTI; NTIS (US Sales Only); INIS.

High magnetization YBaCuO superconductor was prepared with additions of $BaSnO_3$, SnO_2 and SiC by partial melt processing. Addition of $BaSnO_3$ increased the magnetic property of YBaCuO by flux pinning action of finely dispersed $BaSnO_3$ particles, while addition of SnO_2 decreased the magnetic property, because the size of particle was larger than that of $BaSnO_3$. BiPbSrCaCuO superconducting tape of single filament was prepared by powder-in-tube method using silver as a shearth material. The fabrication techniques involves powder packing, swaging, drawing and cold rolling/pressing method. The final dimension of wire after drawing is 1.2mm diameter. The wire was pressed into a tape form with a thickness of 70micron and a width of 3mm. The obtained critical current density of the prepared tape was 2000A/cm^2 at 77K. (Author).

2227 (KAERI/RR–1044/91) **A study on the development of high Tc superconducting materials.** Won, D. Y. (Korea Atomic

Energy Research Inst., Daeduk (Korea, Republic of)); Hong, G. Y.; Lee, H. G.; Lee, H. J.; Kim, C. J.; Kwon, S. C.; Kim, K. B.; Kang, Y. H.; Chang, I. S.; Choi, M. J. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Jan 1992. 89p. (In Korean). Order Number DE93606394. Source: OSTI; NTIS (US Sales Only); INIS.

The major work of this project aims to develop the frictionless superconducting bearing with a high speed. The high magnetization YBaCuO bulk superconductor was prepared by Quasi-melt process. The frictionless superconducting magnetic bearing standed a rotating bar with a speed of 75,000 rpm, which were operated by an electric controller. The low temperature chemical vapor deposition technique was developed. YBaCuO superconducting film showing a superconductivity above 77K was successfully prepared at 650 deg C. Effect of oxygen partial pressure, substrate, deposition temperature on the film properties were also investigated. (Author).

2228 (LA-UR-92-3055) **Three-terminal devices of high-T_c superconductors: A status report and future challenges.** Kung, Pang-Jen (Los Alamos National Lab., NM (United States)). Los Alamos National Lab., NM (United States). [1992]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-920802–15: Applied superconductivity conference, Chicago, IL (United States), 23-28 Aug 1992). Order Number DE93000654. Source: OSTI; NTIS; INIS; GPO Dep.

A study has been conducted on the recent progress of the three-terminal devices with transistor-like characteristics fabricated from the high-T_c superconducting materials. This study explored the operating principles and characteristics of these devices in relation to the relevant materials and techniques. A comparison of a variety of techniques for superconducting thin film deposition will be given. This study indirates that the feasibility of fabricating hybrid devices composed of semiconductors and superconductors appear to be the key issue to push forward the applications of high-T_c superconductors in microelectronics. The junction field-effect transistors with a semiconductor base controlled by the proximity effect are likely to be more manufacturable. The factors that influence the operating reliability of devices and the problems arising from integrating and packaging the devices will also be discussed.

665430 Other Topics in Quantum Fluids and Solids

2229 (INIS-BR–2933, pp. 231) **Peierls-Hubbard finite systems.** Lagos, R.E. (Universidade Estadual de Campinas, SP (Brazil). Inst. de Fisica). Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. ELECTRON-ELECTRON INTERACTIONS/crystal models; ELECTRON-PHONON COUPLING; MAGNETIC SUSCEPTIBILITY

2230 (INIS-BR–2933, pp. 232) **The finite U Hubbard model by Kadanoff-Baym method.** Foglio, M.E. (Universidade Estadual de Campinas, SP (Brazil). Inst. de Fisica). Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. U CENTERS/equations of motion

2231 (INIS-BR–2933, pp. 232) **Electronic structure of $A(B_{(1-x)}B'_{(x)})_2$ systems.** Silva, C.M. da (Santa Maria Univ., RS (Brazil). Dept. de Fisica); Gomes, A.A. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. BINARY ALLOY SYSTEMS/electronic structure; MATHEMATICAL MODELS

2232 (INIS-BR–2933, pp. 233) **Local description for two interacting Anderson impurities.** Rosa Simoes, A. da (Rio Grande do Sul Univ., Porto Alegre, RS (Brazil). Inst. de Fisica); Iglesias, J.R.; Coqblin, B. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. HAMILTONIANS/impurities; COULOMB FIELD; ELECTRON EXCHANGE; GROUND STATES; HAMILTONIANS; IMPURITIES; KONDO EFFECT; MAGNETIC SUSCEPTIBILITY

2233 (INIS-BR–2933, pp. 233) **Structural stability principia.** Cressoni, J.C. (Alagoas Univ., Maceio, AL (Brazil). Dept. de Fisica); Pettifor, D.G. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. STRUCTURE FACTORS/stability; ENERGY LEVELS; STABILITY

2234 (INIS-BR–2933, pp. 234) **Magnetic susceptibility of dimerized Hubbard chain.** Bernhard, B.H. (Rio Grande do Sul Univ., Porto Alegre, RS (Brazil). Inst. de Fisica); Iglesias, J.R. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. DIMERS/magnetic susceptibility; COULOMB FIELD; DIMERS; HAMILTONIANS; TEMPERATURE DEPENDENCE

2235 (INIS-BR–2933, pp. 242) **Impurity states in surfaces and metallic films.** Castro Brabosa, A.C. de (Universidade Federal Fluminense, Niteroi, RJ (Brazil). Inst. de Fisica); D'Albuqerque e Castro, J. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

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2236 (INIS-BR–2933, pp. 233) **Specific heat of Anderson.** Brunet, L.G. (Rio Grande do Sul Univ., Porto Alegre, RS (Brazil). Inst. de Fisica); Gusmao, M.A.; Iglesias, J.R. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

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2237 (INIS-BR–2933, pp. 242) **Static electric conductivity in periodic Anderson model.** Consiglio, R. (Rio Grande do Sul Univ., Porto Alegre, RS (Brazil). Inst. de Fisica); Gusmao, M.A. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. CRYSTAL MODELS/electric conductivity; CORRELATION FUNCTIONS; KONDO EFFECT; TRANSPORT

2238 (INIS-BR–2933, pp. 242) **Cumulative expansion for Anderson lattices.** Figueira, M.S. (Universidade Federal Fluminense, Niteroi, RJ (Brazil). Inst. de Fisica); Foglio, M.E. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. HAMILTONIANS/crystal lattices; HAMILTONIANS; RARE EARTHS; SPECTRAL DENSITY

2239 (INIS-BR–2933, pp. 258) **$CdTe_xS_{1-x}$ quantum box doped glass.** Medeiros Neto, J.A. (Universidade Estadual de Campinas, SP (Brazil). Inst. de Fisica); Barbosa, L.C.; Cesar, C.L.; Alves, O.L.; Galembeck, F. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. DOPED MATERIALS/bohr theory; CADMIUM SULFIDES; CADMIUM TELLURIDES; CONFINEMENT; GLASS

2240 (INIS-BR–2933, pp. 272) **New magneto-optical effects in the vicinity of magnetic dichroic absorption bands.** Leitao, U.A. (Minas Gerais Univ., Belo Horizonte, MG (Brazil). Dept. de Fisica). Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. MAGNETO-OPTICAL EFFECTS/doped materials; CRYSTALS; DICHROISM; FARADAY EFFECT; POLARIZATION

2241 (INIS-BR–2933, pp. 275) **Superficial polaritons in magnetic wires.** Almeida, N.S. (Rio Grande do Norte Univ., Natal, RN (Brazil)); Oliveira, N.T.; Vasconcelos, E.F.; Farias, G.A. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. ANTIFERROMAGNETIC MATERIALS/polarons; POLARONS; ASYMMETRY; CYLINDRICAL CONFIGURATION; DISPERSION RELATIONS; MAGNETIC SUSCEPTIBILITY

2242 (INIS-BR–2933, pp. 281) **Disordered bipolaron lattices.** Galvao, D.S. (Universidade Estadual de Campinas, SP (Brazil). Inst. de Fisica); Santos, M.C. dos. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. CRYSTAL LATTICES/polarons; POLARONS; ELECTRONIC STRUCTURE; ONE-DIMENSIONAL CALCULATIONS; THIOPHENE

2243 (INIS-BR–2933, pp. 281) **The electronic study of mislinked disordered poly-furan.** Oliveira Dantas, S. de (Universidade Estadual de Campinas, SP (Brazil). Inst. de Fisica); Galvao, D.S. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. POLYMERS/electronic structure; ORDER PARAMETERS; POLARONS; POLYMERS

2244 (INIS-BR–2933, pp. 282) **Variational-perturbative treatment of time dependent optical response of conjugated chains.** Mello, C.P. de (Pernambuco Univ., Recife, PE (Brazil). Dept. de Fisica). Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. PERTURBATION THEORY/density matrix; VARIATIONAL METHODS/density matrix; BOLTZMANN-VLASOV EQUATION; ORGANIC COMPOUNDS; POLARIZABILITY; TIME DEPENDENCE

2245 (INIS-BR–2933, pp. 282) **Disordered distribution of defects and extended states in polyacetylene.** Lavarda, F.C. (Universidade Estadual de Campinas, SP (Brazil). Inst. de Fisica); Galvao, D.S.; Laks, B. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. CRYSTAL DEFECTS/order parameters; ACETYLENE; FERMI LEVEL; SOLITONS

2246 (INIS-BR–2933, pp. 283) **Polarizability of one-dimensional chains.** Melo, C.P. de (Pernambuco Univ., Recife, PE (Brazil). Dept. de Fisica); Kirtman, B. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

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2247 (INIS-BR–2933, pp. 311) **Oscillations in magnetoresistance of two-dimensional electron gas submitted to periodic potential.** Alves, E.S. (Minas Gerais Univ., Belo Horizonte, MG (Brazil). Inst. de Ciencias Exatas); Beton, P.H.; Eaves, L.; Main, P.C. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

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2248 (INIS-BR–2933, pp. 312) **Electronic states in Ge/Si superlattices studied by electro-reflectance.** Rodrigues, P.A.M. (Universidade Estadual de Campinas, SP (Brazil). Inst. de Fisica); Lemos, V.; Mendes, G.; Cerdeira, F. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

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2249 (INIS-BR–2933, pp. 312) **Measurements of photoreflectance in δ-doping.** Novellino, R.A. (Universidade Estadual de Campinas, SP (Brazil). Inst. de Fisica); Motisuke, P.; Bernussi, A.A.; Basmaji, P. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

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ARSENIDES; SPECTRA; TEMPERATURE RANGE 0013-0065 K; TEMPERATURE RANGE 0065-0273 K

2250 (INIS-BR–2933, pp. 313) **GaAs-(Ga,Al)As quantum wires: a study on photoluminescence spectrum related to plain receiver impurities.** Latge, A. (Universidade Federal Fluminense, Niteroi, RJ (Brazil)); Porras M, N.; Oliveira, L.E. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

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2251 (INIS-BR–2933, pp. 337) **Cyclotron resonance in GaAs-GaSb heterojunction: effect of interfacial electron-phonon coupling.** Osorio, F.A.P. (Goias Univ., Goiania, GO (Brazil). Dept. de Fisica); Hipolito, O. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

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2252 (INIS-BR–2933, pp. 337) **Effects of electric field on transmission coefficient of non-abrupt GaAs/$Ga_{1-x}Al_xAs$ heterojunction.** Auto, M.M. (Ceara Univ., Fortaleza, CE (Brazil)); Farias, G.A.; Freire, V.N. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

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2253 (INIS-BR–2933, pp. 338) **Light scattering in quantum-well semiconductors.** Costa, C.R. (Brasilia Univ., DF (Brazil). Dept. de Fisica); Morais, P.C.; Nunes, A.C. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

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2254 (INIS-BR–2933, pp. 338) **Study on electronic structure of silicon using large unit cell approximation.** Waki, P.S. (Escola Federal de Engenharia de Itajuba, MG (Brazil)); Pereira Neto, J.R. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

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2255 (INIS-BR–2933, pp. 339) **Optical and electrical properties of δ-doped in GaAs growth by molecular beam epitaxy.** Notari, A.C. (Sao Paulo Univ., Sao Carlos, SP (Brazil). Inst. de Fisica e Quimica); Schrappe, B.; Basmaji, P.; Li, M.S.; Hipolito, O.; Bernussi, A.A. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

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2256 (INIS-BR–2933, pp. 339) **Results of photomodulated spectroscopy in superlattices and quantum wells of $In_xGa_{1-x}As/GaAs$.** Ribeiro, E. (Universidade Estadual de Campinas, SP (Brazil). Inst. de Fisica); Cerdeira, F.; Motisuke, P.; Vazquez-Lopez, C.; Sacilotti, M.A.; Roth, A.P. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

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2257 (INIS-BR–2933, pp. 339) **States of Yb impurities in semiconducting III-V crystals.** Macedo, T.C.A. (UNESP, Guaratingueta, SP (Brazil). Faculdade de Engenharia); Nery, S.M. del; Rangel, E.C.; Ikeda, L.H. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

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2258 (INIS-BR–2933, pp. 346) **Dynamics in anisotropic antiferromagnets.** Majlis, N. (Universidade Federal Fluminense, Niteroi, RJ (Brazil). Inst. de Fisica); Selzer, S.; Strinati, G. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

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2259 (INIS-BR–2933, pp. 347) **Elastic properties of vortice lattices in layer structure superconductors.** Carneiro, G. (Pontificia Univ. Catolica do Rio de Janeiro, RJ (Brazil). Dept. de Fisica). Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

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2260 (INIS-BR–2933, pp. 347) **Measurements of thermal diffusivity in polycrystal samples of $YBa_2Cu_3O-7_{-x}$ ($x \simeq 0,1$).** D'Azeredo Orlando, M.T. (Instituto de Pesquisas Energeticas e Nucleares (IPEN), Sao Paulo, SP (Brazil)); Gomes, L.; Rossi, W. de; Vieira, M.M.F.; Jorge, M.P.P.; Grigoletto, T.; Martinez, L.G.; Morato, S.P. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

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CONDUCTIVITY; MAGNETIC SUSCEPTIBILITY; POLYCRYSTALS; STOICHIOMETRY; X-RAY DIFFRACTION; YTTRIUM

2261 (INIS-BR–2933, pp. 348) **Microwave absorption in oriented superconducting samples.** Melo, M.T. de (Pernambuco Univ., Recife, PE (Brazil). Dept. de Fisica); Ferreira, J.M. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

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2262 (INIS-BR–2933, pp. 349) **Influence of microstructure on irreversibility curve of $YBa_2Cu_3O_{7-\delta}$.** Andrade Junior, R. de (Universidade Estadual de Campinas, SP (Brazil). Inst. de Fisica); Campos, S.P. de; Avila, M.A.; Lima, O.F. de. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

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2263 (INIS-BR–2933, pp. 350) **Conductance in high T_c compounds.** Lagos, R.E. (Universidade Estadual de Campinas, SP (Brazil). Inst. de Fisica). Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

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2264 (INIS-BR–2933, pp. 350) **Influence of oxygen concentration on irreversibility curve of BI (2122) monocrystals.** Moehlecke, S. (Universidade Estadual de Campinas, SP (Brazil). Inst. de Fisica); Torikachvili, M.S. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

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2265 (INIS-BR–2933, pp. 350) **Electronic structure and optical spectra of $YBa_2Cu_{3-x}M_xO_{7-\delta}$ superconductor.** Lima, G.A.R. (Sao Paulo Univ., SP (Brazil). Inst. de Fisica); Mota, R.; Fazzio, A. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

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2266 (INIS-BR–2933, pp. 351) **Pair formation and Bose condensation in square lattice.** Mello, E.V.L. de (Universidade Federal Fluminense, Niteroi, RJ (Brazil). Dept. de Fisica). Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

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2267 (INIS-BR–2933, pp. 356) **Hysteretic losses in NbTi superconducting wires.** Ramos, M.J. (Fundacao de Tecnologia Industrial (FTI), Lorena, SP (Brazil). Centro de Materiais Refratarios); Shigue, C.Y. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

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2268 (INIS-BR–2933, pp. 369) **Relaxation of Fermi level on interface formation.** Souza, F.J.O. de (Pernambuco Univ., Recife, PE (Brazil). Dept. de Fisica); Melo, C.P. de. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

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2269 (INIS-BR–2933, pp. 370) **Theory on monolayer magnetic properties of transition metals at finite temperature.** Pini, M.G. (Consiglio Nazionale delle Ricerche, Florence (Italy). Ist. di Elettronica Quantistica); Rettori, A.; Pescia, D.; Majlis, N.; Selzer, S. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

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2270 (INIS-BR–2933, pp. 373) **Automatic determination of film parameters by transmission spectrum.** Silva, F.C. da (Pontificia Univ. Catolica do Rio de Janeiro, RJ (Brazil)); Nunes, R.A.; Carmo, L.C.S.; Paciornik, S.; Souza Camargo Junior, S.A. de. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

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2271 (INIS-BR–2933, pp. 314) **Excitonic optical transitions in strained heterostructures.** Cohen, A.M. (Amazonas Univ., Manaus, AM (Brazil). Dept. de Fisica); Aladim, S.R.; Marques, G.E. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

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2272 (INIS-BR–2933, pp. 315) **Photoluminescence of a-Ge:H.** Marcano, G. (Universidade Estadual de Campinas, SP (Brazil). Inst. de Fisica); Chambouleyron, I. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

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2273 (INIS-BR–2933, pp. 315) **Pressure and composition effects on gap properties of $Al_xGa_{e-x}As$.** Capaz, R.B. (Pontificia Univ. Catolica do Rio de Janeiro, RJ (Brazil). Dept. de Fisica); Koiller, B.; Weid, J.P. von der. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

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2274 (INIS-BR–2933, pp. 316) **A self-consistent calculation of electronic and transport properties of a semiconductor microchannel.** Anda, E.V. (Universidade Federal Fluminense, Niteroi, RJ (Brazil). Inst. de Fisica); Makler, S.S.; Pernas, P.L.; Flores, F. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

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2275 (INIS-BR–2933, pp. 316) **Determination of Auger recombination coefficient in semiconductors II-VI.** Cruz, J.M.R. (Brasilia Univ., DF (Brazil). Dept. de Fisica); Driel, H.M. van. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

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2276 (INIS-BR–2933, pp. 316) **Photoluminescence of the $Ga_{1-x}Al_xAs$:si confining layer of doped asymmetrically quantum wells (SAQW) growth by MBE.** Mendes, W.M. (Pontificia Univ. Catolica do Rio de Janeiro, RJ (Brazil)); Weid, J.P. von der; Souza, P.L.; Dias, I.F.L. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

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2277 (INIS-BR–2933, pp. 317) **The influence of the initial quasi-equilibrium temperature of phonons on dynamic of photoexcited hot carriers.** Maia, A.E.P. (Ceara Univ., Fortaleza, CE (Brazil). Dept. de Fisica); Freire, V.N. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

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2278 (INIS-BR–2933, pp. 317) **Transport transients in intense fields of multi-valley GaAs by using a phenomenological model.** Alencar, A.M. (Ceara Univ., Fortaleza, CE (Brazil). Dept. de Fisica); Freire, V.N.; Costa, J.A.P. da. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

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2279 (INIS-BR–2933, pp. 332) **Shielding of electron-phonon interaction in polar semiconductors.** Costa, W.B. da (Sao Paulo Univ., Sao Carlos, SP (Brazil). Inst. de Fisica e Quimica); Studart, N. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

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2280 (INIS-BR–2933, pp. 319) **Models for semiconductor defects.** Baierle, R. (Sao Paulo Univ., SP (Brazil). Inst. de Fisica); Caldas, M.J. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

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2281 (INIS-BR–2933, pp. 319) **Impurity-related optical absorption and photoluminescence spectra of GaAs-$Ga_{1-x}Al_xAs$ cylindrical quantum-well wires.** Montenegro, N.P. (Valle Univ., Cali (Colombia)); Latge, A.; Oliveira, L.E. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. GALLIUM ARSENIDES/impurities; GALLIUM ARSENIDES/photoluminescence; ABSORPTION; ALUMINIUM ARSENIDES; IMPURITIES; PHOTOLUMINESCENCE; MATHEMATICAL MODELS; QUANTUM ELECTRONICS; WIRES

2282 (INIS-BR–2933, pp. 320) **Experiments for studying electronic transitions between confined states in GaAs with δ-doping by means of resonant Raman scattering.** Cerdeira, F. (Universidade Estadual de Campinas, SP (Brazil). Inst. de Fisica); Mestres, N.; Meseguer, F.; Ruiz, A.; Briones, F.; Ploog, K. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

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2283 (INIS-BR–2933, pp. 322) **Spin states of first conduction sub-band of a semi-conducting heterostructure.** Andrada e Silva, E.A. de (Instituto de Pesquisas Espaciais (INPE), Sao Jose dos Campos, SP (Brazil)). Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. CRYSTAL STRUCTURE/spin; ALUMINIUM COMPOUNDS; BAND THEORY; SPIN; ELECTRIC FIELDS; ENERGY DEPENDENCE; ENERGY LEVELS; GALLIUM ARSENIDES; HAMILTONIANS; L-S COUPLING; SEMICONDUCTOR MATERIALS

2284 (INIS-BR–2933, pp. 322) **Impedance spectroscopy and optical modulation of Schottky barrier type devices and silicon MOS.** Fantini, M.C.A. (Sao Paulo Univ., SP (Brazil). Inst. de Fisica); Shen, W.M.; Tonkiewicz, M.; Gambino, J.P. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

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2285 (INIS-BR–2933, pp. 323) **Exciton binding energy in ultra thin InGaAs/InP single quantum wells.** Morais, P.C. (Brasilia Univ., DF (Brazil). Dept. de Fisica); Cox, H.M. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. EXCITONS/binding energy; CRYSTAL GROWTH; EXCITONS; GALLIUM ARSENIDES; INDIUM COMPOUNDS; PHOTOLUMINESCENCE; THICKNESS

2286 (INIS-BR–2933, pp. 323) **Dynamic and transient transport of minority electrons in p-GaAs.** Alencar, A.M. (Ceara Univ., Fortaleza, CE (Brazil). Dept. de Fisica); Nobre, F.A.S.; Sampaio, A.J.C.; Freire, V.N.; Costa, J.A.P. da. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. ELECTRON-HOLE COUPLING/gallium arsenides; BOLTZMANN EQUATION; DYNAMICS; RELAXATION TIME; TRANSIENTS; TRANSPORT

2287 (INIS-BR–2933, pp. 323) **Optical absorption in quantum well doped and compensated in the presence of magnetic field.** Emmel, P.D. (Sao Paulo Univ., SP (Brazil). Inst. de Fisica). Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

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2288 (INIS-BR–2933, pp. 324) **Structural model for vitreous boron trioxide in hyperbolic space.** Miranda Neto, J.A. de (Pernambuco Univ., Recife, PE (Brazil). Dept. de Fisica); Moraes, F. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

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2289 (INIS-BR–2933, pp. 324) **Electronic structure of $(GaP)_n(InP)_n$ and $(GaAs)_n(InAs)_n$ superlattices with $n \leq 7$.** Figueiredo, S.K. de; Ferraz, A.C. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

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2290 (INIS-BR–2933, pp. 325) **Interband transport in InAs/AlSb/GaSb heterostructures.** Davidovich, M.A. (Pontificia Univ. Catolica do Rio de Janeiro, RJ (Brazil). Dept. de Fisica); Anda, E.V.; Tejedor, C. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

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2291 (INIS-BR–2933, pp. 325) **Superlattices submitted to electric and magnetic fields.** Freire, J.A. (Pontificia Univ. Catolica do Rio de Janeiro, RJ (Brazil). Dept. de Fisica); Davidovich, M.A. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

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2292 (INIS-BR–2933, pp. 329) **Franz-Keldysh oscillation associated to exciton in GaAs.** Schmidt, C. (Universidade Estadual de Campinas, SP (Brazil). Inst. de Fisica); Novellino, R.A.; Motisuke, P. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

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2293 (INIS-BR–2933, pp. 330) **Electron resonant magnetotunneling in quantum points.** Farinas, P.E.F. (Sao Carlos Univ., SP (Brazil). Dept. de Fisica); Studart, N. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

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2294 (INIS-BR–2933, pp. 331) **Light propagation in quasi-periodic superlattices.** Latge, A. (Universidade Federal Fluminense, Niteroi, RJ (Brazil)); Claro, F. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

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2295 (INIS-BR–2933, pp. 332) **Car-Parrinello molecular dynamics in treatment of defects in GaAs.** Schmidt, T.M. (Sao Paulo Univ., SP (Brazil). Inst. de Fisica); Antonelli, A.; Piquini, P.; Fazzio, A. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

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2296 (INIS-BR–2933, pp. 333) **Miniband structures of periodically δ-doped GaAs.** Camilo, J. (Sao Paulo Univ., Sao Carlos, SP (Brazil). Inst. de Fisica e Quimica); Egues, J.C.; Ioriatti, L. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

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2297 (INIS-BR–2933, pp. 333) **Conduction sub-bands of PbTe-$Pb_{1-x}Sn_xTe$ superlattice under magnetic field parallel to interfaces.** Dois L, M. de (Havana Univ., La Habana (Cuba). Dept. of Theoretical Physics); Andrara e Silva, E.A. de. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. SUPERLATTICES/magnetic fields; EFFECTIVE MASS; ENERGY DEPENDENCE; INTERFACES; LEAD TELLURIDES; MASS RENORMALIZATION; SCHROEDINGER EQUATION; SUPERLATTICES; TIN COMPOUNDS; VALENCE

2298 (INIS-BR–2933, pp. 334) **Photoluminescence in asymmetrically doped quantum wells.** Dias, I.F.L. (Universidade Estadual de Londrina, PR (Brazil)); Duarte, J.L.; Mendes, W.M.; Sanjurjo, J.A.; Oliveira, A.G. de. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. SUPERLATTICES/photoluminescence; DOPED MATERIALS; LAYERS; MOBILITY; SUPERLATTICES; PHOTOLUMINESCENCE

2299 (INIS-BR–2933, pp. 335) **Analysis of transition in the interface of AlGaInAs/InP heterostructure as function of aluminium proportion in the alloy.** Montes, C.B.P. (Universidade Estadual de Campinas, SP (Brazil). Inst. de Fisica); Motisuke, P.; Sacilotti, M.A. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. INTERFACES/photoluminescence; ALUMINIUM COMPOUNDS; CHEMICAL VAPOR DEPOSITION; GALLIUM ARSENIDES; HETEROJUNCTIONS; INDIUM COMPOUNDS; INTERFACES; PHOTOLUMINESCENCE; PHOSPHORUS COMPOUNDS; QUANTITY RATIO; VALENCE

2300 (INIS-BR–2933, pp. 335) **Optical properties of As_2S_3 amorphous system.** Amato, M.A. (Brasilia Univ., DF (Brazil). Dept. de Fisica). Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. SEMICONDUCTOR MATERIALS/optical properties; AMORPHOUS STATE; ARSENIC SULFIDES; IMPURITIES

2301 (INIS-BR–2933, pp. 335) **Intra and inter-sub-band transitions in quantum wires.** Araujo Leao, S. de (Sao Paulo Univ., Sao Carlos, SP (Brazil). Inst. de Fisica e Quimica); Hipolito, O. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

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2302 (INIS-BR–2933, pp. 336) **Diffusion of tin in gallium arsenides by rapid thermal processing.** Hernandes, C.S. (Universidade Estadual de Campinas, SP (Brazil). Inst. de Fisica); Swart, J.W. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. CRYSTAL DOPING/diffusion; DIFFUSION; GALLIUM ARSENIDES; HALL EFFECT; HEAT TREATMENTS; TIN

2303 (INIS-BR–2933, pp. 336) **Tunneling between two-dimensional systems.** Neves, B.R.A. (Minas Gerais Univ., Belo Horizonte, MG (Brazil). Inst. de Ciencias Exatas); Sampaio, J.F. de; Oliveira, A.G. de; Carvalho, R.P. de. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. TUNNEL EFFECT/two-dimensional calculations; ELECTRIC CONDUCTIVITY; SELECTION RULES

2304 (INIS-mf–13358, pp. 23) **Electronic transport in coupled quantum wells.** Palevski, A. (Tel Aviv Univ. (Israel)). Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Physics. 1992. 169p. (CONF-9204195–: 1992 Israel Physical Society annual meeting, Rehovot (Israel), 15 Apr 1992). In *Israel physical society 1992 annual meeting: Program and abstracts.* Order Number DE93604079. Source: OSTI; NTIS (US Sales Only); INIS.

Abstract only. ELECTRIC POTENTIAL/asymmetry; SCHROEDINGER EQUATION/electric conductivity; SCHROEDINGER EQUATION/electric potential; CHARGED-PARTICLE TRANSPORT THEORY; ASYMMETRY; ELECTRONS; WAVE FUNCTIONS

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Refer also to citation(s) 992, 2383, 2393

2305 (CONF-920142–2) **Tokamak turbulence in self-regulated differentially rotating flow and L-H transition dynamics.** Terry, P.W. (Wisconsin Univ., Madison, WI (United

States). Dept. of Physics); Diamond, P.H.; Carreras, B.A.; Sidikman, K. Oak Ridge National Lab., TN (United States). [1992]. 34p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400 ;FG02-89ER53291. From International topical conference on new ideas in tokamak confinement; La Jolla, CA (United States); 27-29 Jan 1992. Order Number DE93000443. Source: OSTI; NTIS; INIS; GPO Dep.

An analytical study of turbulence in the presence of turbulently generated differentially rotating flow is presented as a paradigm for fluctuation dynamics in L- and H-mode plasmas. Using a drift wave model, the role of both flow shear and flow curvature (second radial derivative of the poloidal ExB flow) is detailed in linear and saturated turbulence phases. In the strong turbulence saturated state, finite amplitude-induced modification of the fluctuation structure near low order rational surfaces strongly inhibits flow shear suppression. Suppression by curvature is not diminished, but it occurs through a frequency shift. A description of L-H mode transition dynamics based on the self-consistent linking of turbulence suppression by differentially rotating flow and generation of flow by turbulent momentum transport is presented. In this model, rising edge temperature triggers a transition characterized by spontaneous generation of differentially rotating flow and decreasing turbulence intensity.

2306 (CONF-920913–4) **Fluctuation studies of ECH plasmas in the ATF torsatron and the IMS stellarator.** Harris, J.H. (Oak Ridge National Lab., TN (United States)); Wilgen, J.B.; Murakami, M.; Baylor, L.R.; Bigelow, T.S.; Colchin, R.J.; Dory, R.A.; Dominguez, N.; Dunlap, J.L.; Dyer, G.R.; England, A.C.; Isler, R.C.; Jernigan, T.C.; Lyon, J.F.; Ma, C.H.; MioduOak Ridge National Lab., TN (United States). [1992]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 14. international conference on plasma physics and controlled nuclear fusion research; Wuerzburg (Germany); 30 Sep - 7 oct 1992. Order Number DE93001204. Source: OSTI; NTIS; INIS; GPO Dep.

The results of experimental studies of fluctuations and transport in ECH plasmas in the ATF torsatron and the IMS stellarator are presented. In ATF, a variety of diagnostics have been used to measure turbulence amplitudes and spectral characteristics throughout the plasma. In the plasma core, density fluctuations with characteristics like those expected for drift waves (possibly connected with trapped electron effects) are seen. In the gradient region, the density fluctuation levels are consistent with those expected for resistive interchange turbulence. In the edge, fluctuations appear to be correlated with density gradients, and the fluctuation-induced particle flux and global particle confinement can be influenced by positive limiter biasing. In IMS, whose parameters model those in the edge of larger devices, two-dimensional (2-D) probe measurements show substantial poloidal variations in the fluctuation-induced particle flux that are most pronounced at the plasma edge; as in ATF, the particle flux can be reduced by positive limiter biasing. The 2-D probe measurements also show good agreement between the plasma poloidal flow velocities determined from the Reynolds stress and force balance.

2307 (CONF-921217–1-Extd.Abst.) **Calibration of an infrared polarimeter for Alcator C-Mod.** Ma, C.H. (Oak Ridge National Lab., TN (United States)); Hutchinson, D.P.; Irby, J. Oak Ridge National Lab., TN (United States). [1992]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 17. annual SPIE international conference on infrared and millimeter wave sources; Pasadena, CA (United States); 14-18 Dec 1992. Order Number DE92041308. Source: OSTI; NTIS; INIS; GPO Dep.

An infrared polarimeter system for measurement of the plasma current density in Alcator C-Mod tokamak has been fabricated and tested. The system utilizes a cw CO_2 laser at a wavelength of 10.6 μm. Polarization-modulation techniques have been used to achieve the high sensitivity required for the measurement. The preliminary results of a feasibility study of the system for the International Thermonuclear Experimental Reactor (ITER) are also presented.

2308 (CTH-IEFT-PP–1992-06) **Orbit losses of strongly ICRF-heated ions.** Anderson, A.; Dillner, Oe.; Lisak, M. Chalmers Univ. of Technology, Goeteborg (Sweden). Inst. for Electromagnetic Field Theory and Plasma Physics. 1992. 14p. Order Number DE93606269. Source: OSTI; NTIS; INIS.

An approximate analytical investigation is made to assess the importance of orbit losses of strongly ICRF-heated minority ions. Explicit expressions for the fraction of lost minority ions are derived and shown to be in good agreement with numerical simulation results. The results indicate that present day ICRF heating power density levels cannot be raised significantly without causing important particle and energy losses due to unconfined particle orbits. 6 refs., 5 figs.

2309 (CTH-IEFT-PP–1992-10) **Simulation of a coupled dynamic system of temperature and density in a fusion plasma.** Le Roux, M.N. (Centre de Recherche en Mathematiques, Universite de Bordeaux I, Talance Cedex (France)); Weiland, J.; Wilhelmsson, H. Chalmers Univ. of Technology, Goeteborg (Sweden). Inst. for Electromagnetic Field Theory and Plasma Physics. [1992]. 32p. Order Number DE93606236. Source: OSTI; NTIS; INIS.

Simulation studies of a coupled system of equations for the evolution of temperature and density have been performed. The results are presented in graphs displaying the evolution in time of the temperature and density profiles, as well as in phase-plane plots, relating the central values of temperature and density. Particular emphasis is devoted to the particle and heat pinch effects, which tend to counter-balance the ordinary diffusion, and to co-operate with the alpha particle heating in sustaining plasma equilibrium. Oscillatory approaches to equilibria are recorded. 28 refs., 20 figs.

2310 (CTH-IEFT-PP–1992-12) **Effect of sawteeth on alpha power deposition and ignition in Tokamaks.** Kolesnichenko, Ya.I. (Inst. for Nuclear Research of the Academy of Sciences, Kiev (Ukraine) and Chalmers Univ. of Technology, Goeteborg (Sweden). Inst. for Electromagnetic Field Theory and Plasma Physics); Lutsenko, V.V.; Yakovenko, Yu.V. Chalmers Univ. of Technology, Goeteborg (Sweden). Inst. for Electromagnetic Field Theory and Plasma Physics. [1992]. 26p. Order Number DE93606270. Source: OSTI; NTIS; INIS.

The main features of the alpha particle heating, ignition and thermonuclear burn in a tokamak plasma with sawtooth oscillations are revealed. The sensitivity of results against the various model of sawteeth and characteristics of the safety factor q(r) is investigated. Analysis of ignition is best applicable to the case $T_\epsilon < T_r, T_\epsilon$ being the alpha particle energy loss time, T_r period of sawtooth oscillations.

2311 (DOE/ER/51124–7) **High beta and second stability region transport and stability analysis: Final report.** Hughes, M.H.; Phillps, M.W.; Todd, A.M.M.; Krishnaswami, J.; Hartley, R. Grumman Corp., Princeton, NJ (United States). Sep 1992. 90p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-89ER51124. Order Number DE93000886. Source: OSTI; NTIS; INIS; GPO Dep.

This report describes ideal and resistive studies of high-beta plasmas and of the second stability region. Emphasis is focused on "supershot" plasmas in TFIR where MHD instabilities are frequently observed and which spoil their confinement properties. Substantial results are described from the analysis of these high beta poloidal plasmas. During these studies, initial pressure and safety factor profiles were obtained from the TRANSP code, which is used extensively to analyze experimental data. Resistive MBD stability studies of supershot equilibria show that finite pressure stabilization of tearing modes is very strong in these high βp plasmas. This has prompted a detailed re-examination of linear tearing mode theory in which we participated in collaboration with Columbia University and General Atomics. This finite pressure effect is shown to be highly sensitive to small scale details of the pressure profile. Even when an ad hoc method of removing this stabilizing mechanism is implemented, however, it is shown that there is only superficial agreement between resistive MBD stability computation and the experimental data. While the mode structures observed experimentally can be found computationally, there is no convincing correlation with the experimental observations when the computed results are compared with a large set of supershot data. We also describe both the ideal and resistive stability properties of TFIR equilibria near the transition to the second region. It is shown

that the highest β plasmas, although stable to infinite-n ideal ballooning modes, can be unstable to the so called "infernal" modes associated with small shear. The sensitivity of these results to the assumed pressure and current density profiles is discussed. Finally, we describe results from two collaborative studies with PPPL. The first involves exploratory studies of the role of the 1/1 mode in tokamaks and, secondly, a study of sawtooth stabilization using ICRF.

2312 (DOE/ER/53198–199) **Plasma physics research in the MST toroidal confinement device: Progress report, November 1, 1991–June 15, 1992.** Wisconsin Univ., Madison, WI (United States). [1992]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-85ER53198. Order Number DE93000491. Source: OSTI; NTIS; INIS; GPO Dep.

Below is a brief project report covering the first 7-1/2 months of FY92. The report is composed of a list of projects divided into three categories. The first list of "completed physics projects" includes studies which have reached firm conclusions which have been or are being submitted for publication. The second list of "ongoing projects" are mostly physics tasks which are underway. the third list of "diagnostic development" tasks includes completed general-use machine diagnostics and special-purpose diagnostics under development. The division between the last two lists is somewhat arbitrary. The list of projects includes both major group efforts and low-level tasks. The weighting and personnel allocations are not indicated in this report.

2313 (DOE/ER/53225–2) **Studies of plasma confinement in linear and RACETRACK mirror configurations: Progress report, Task 4.** Kuthi, A.; Wong, A.Y. California Univ., Los Angeles, CA (United States). Dept. of Physics. 28 May 1989. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG03-86ER53225. Order Number DE93002522. Source: OSTI; NTIS; INIS; GPO Dep.

During the period from November 1988 through April 1989 the experimental plasma physics program at UCLA produced several new results. The experiments were conducted on the toroidal RACETRACK device. Generation of a steady-state high-beta field-reversed configuration in one of the straight sections by the rotating electromagnetic wave technique is now routine and because of understanding gained in the course of experiments we succeeded in extending the range of operation was extended. The pressure balance relation was verified by independent pressure and magnetic field measurements for this field reversed-configuration. Studies of the equilibrium have been extended to spatial and temporal decay of the confining diamagnetic current. It has been observed, that the current decays on the resistive time scale due to electron-ion coulomb collisions. Current injection was also used to study the effects of mirror fields on toroidal currents and to reduce the neutral gas pressure for a given plasma density.

2314 (DOE/ER/53225–T4) **Studies of plasma confinement in linear and RACETRACK mirror configurations: Progress report, January 1–October 31, 1986.** Kuthi, A.; Wong, A.Y. California Univ., Los Angeles, CA (United States). Dept. of Physics. 30 Jun 1986. 92p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG03-86ER53225. Order Number DE93002529. Source: OSTI; NTIS; GPO Dep.

This report discusses research on the following magnetic mirror configurations: Racetrack; ECRH generated plasmas; RF generated plasmas; potential structures; surface multipole fields, and lamex; hot electron physics; axial loss processes; and RF induced effects.

2315 (DOE/ER/53225–T7) **[Magnetic fusion theory and experimental research and development]: Progress report, November 1, 1991–October 30, 1992.** California Univ., Los Angeles, CA (United States). School of Engineering and Applied Science. [1992]. 35p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG03-86ER53225. Order Number DE93002539. Source: OSTI; NTIS; INIS; GPO Dep.

Radial currents have been used for generating plasma rotation. Particularly, oscillating torque experiments were performed. The resulting changes in the particle and heat transport were studied. Controlled variation in the poloidal asymmetry as well as in the plasma potential were induced by biasing. The particle confinement appears to be related to the sign of the radial electric potential. This is connected to the radial electric field and the direction of rotation. The electron diamagnetic drift direction is better. This corresponds to negative electric fields and potential. The poloidal asymmetry was studied in relation to heat confinement.

2316 (DOE/ER/53225–T8) **Applications of computer modeling to fusion research: Progress report, 1988–1989.** Dawson, J.M. California Univ., Los Angeles, CA (United States). Dept. of Physics. [1989]. 24p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG03-86ER53225. Order Number DE93002642. Source: OSTI; NTIS; INIS; GPO Dep.

Progress achieved during this report period is presented on the following topics: Development and application of gyrokinetic particle codes to tokamak transport, development of techniques to take advantage of parallel computers; model dynamo and bootstrap current drive; and in general maintain our broad-based program in basic plasma physics and computer modeling.

2317 (DOE/ER/53275–4) **Investigations in anomalous transport and ignition physics: Annual summary of progress, November 1991–November 1992.** Diamond, P.H.; Rosenbluth, M.N. California Univ., San Diego, La Jolla, CA (United States). Dept. of Physics. Sep 1992. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG03-88ER53275. Order Number DE92040891. Source: OSTI; NTIS; INIS; GPO Dep.

Short communication. H-MODE PLASMA CONFINEMENT; CHARGED-PARTICLE TRANSPORT; PROGRESS REPORT; TURBULENCE; ALFVEN WAVES; PLASMA INSTABILITY; BERNSTEIN MODE

2318 (DOE/ER/53296–3) **Application of optical fluctuation diagnostics to transport studies in high temperature tokamak plasmas: Technical progress report.** Fonck, R.J. Wisconsin Univ., Madison, WI (United States). Dept. of Nuclear Engineering and Engineering Physics. [1992]. 44p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-89ER53296. Order Number DE93000885. Source: OSTI; NTIS; INIS; GPO Dep.

This report reviews work on the following plasma diagnostic techniques: beam emission spectroscopy and alpha-chers diagnostics. (LSP).

2319 (DOE/ER/54149–1) **Measurement of impurity ion densities and energies in the divertor and edge regions of Alcator C-Mod tokamak: Progress report, February 1, 1992–July 31, 1992.** Griem, H.R.; Moreno, J.; Welch, B.L. Maryland Univ., College Park, MD (United States). Lab. for Plasma Research. [1992]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-92ER54149. Order Number DE92040510. Source: OSTI; NTIS; INIS; GPO Dep.

A study to investigate impurity production and transport in the divertor and edge regions of the Alcator C-Mod tokamak through spectroscopic techniques is described. A 0.75-meter Czerny-Turner spectrometer with a 1200-g/mm grating and a 35-meter quartz optic bundle transmission line were tested. A high-resolution 2-meter spectrometer will be ordered. Data acquisition considerations are being addressed. (RWR)

2320 (DOE/ET/53088–563) **Toroidal effects on drift wave turbulence.** LeBrun, M.J.; Tajima, T.; Gray, M.G.; Furnish, G.; Horton, W. Texas Univ., Austin, TX (United States). Inst. for Fusion Studies. 23 Sep 1992. 77p. Sponsored by USDOE, Washington, DC (United States); National Science Foundation, Washington, DC (United States); JIFT Program; Science and Technology Agency, Tokyo (Japan). DOE Contract FG05-80ET53088. (IFSR–563). Order Number DE93000498. Source: OSTI; NTIS; INIS; GPO Dep.

The universal drift instability and other drift instabilities driven by density and temperature gradients in a toroidal system are investigated in both linear and nonlinear regimes via particle simulation. Runs in toroidal and cylindrical geometry show dramatic differences in plasma behavior, primarily due to the toroidicity-induced coupling of rational surfaces through the poloidal mode number m. In the toroidal system studied, the eigenmodes are seen to possess (i) an elongated, nearly global radial extent (ii) a higher growth rate than in the corresponding cylindrical system, (iii) an

eigenfrequency nearly constant with radius, (iv) a global temperature relaxation and enhancement of thermal heat conduction. Most importantly, the measured Xi shows an increase with radius and an absolute value on the order of that observed in experiment. On the basis of our observations, we argue that the increase in Xi with radius observed in experiment is caused by the global nature of heat convection in the presence of toroidicity-induced mode coupling.

2321 (DOE/ET/53088–564) **Particle simulation algorithms with short-range forces in MHD and fluid flow.** Cable, S.; Tajima, T.; Umegaki, K. Texas Univ., Austin, TX (United States). Inst. for Fusion Studies. Jul 1992. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-80ET53088. (IFSR–564). Order Number DE93000407. Source: OSTI; NTIS; INIS; GPO Dep.

Attempts are made to develop numerical algorithms for handling fluid flows involving liquids and liquid-gas mixtures. In these types of systems, the short-range intermolecular interactions are important enough to significantly alter behavior predicted on the basis of standard fluid mechanics and magnetohydrodynamics alone. We have constructed a particle-in-cell (PIC) code for the purpose of studying the effects of these interactions. Of the algorithms considered, the one which has been successfully implemented is based on a MHD particle code developed by Brunel et al. In the version presented here, short range forces are included in particle motion by, first, calculating the forces between individual particles and then, to prevent aliasing, interpolating these forces to the computational grid points, then interpolating the forces back to the particles. The code has been used to model a simple two-fluid Rayleigh-Taylor instability. Limitations to the accuracy of the code exist at short wavelengths, where the effects of the short-range forces would be expected to be most pronounced.

2322 (DOE/ET/53088–566) **Map model for nonlinear alpha particle interaction with toroidal Alfven waves.** Berk, H.L.; Breizman, B.N.; Ye, H. Texas Univ., Austin, TX (United States). Inst. for Fusion Studies. Sep 1992. 30p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-80ET53088. (IFSR–566). Order Number DE93001851. Source: OSTI; NTIS; INIS; GPO Dep.

A map model has been developed for studying the nonlinear interaction of alpha particles with the toroidal Alfven eigenmodes. The map is constructed by assuming a linear interaction during a single poloidal transit, which allows the study of the nonlinear interaction over many transits. By using this map, analytic expressions are obtained for the particle nonlinear bounce frequency, and the wave amplitude threshold for the onset of particle orbit stochasticity. The map model can also facilitate self-consistent simulations which incorporate the time variation of the waves.

2323 (DOE/ET/53088–567) **Particle simulations in toroidal geometry.** Aydemir, A.Y. Texas Univ., Austin, TX (United States). Inst. for Fusion Studies. Sep 1992. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-80ET53088. (IFSR–567;CONF-9206235–2: International Atomic Energy Agency (IAEA) technical committee meeting on advances in simulation and modeling of thermonuclear plasmas, Montreal (Canada), 15 Jun 1992). Order Number DE93000622. Source: OSTI; NTIS; INIS; GPO Dep.

A computational tool to be used in kinetic simulations of toroidal plasmas is being developed. The initial goal of the project is to develop an electrostatic gyrokinetic model for studying transport and stability problems in tokamaks. In this brief report, preliminary results from the early stages of this effort are presented.

2324 (DOE/ET/53088–568) **Electron-temperature-gradient-induced instability in tokamak scrape-off layers.** Berk, H.L. (Texas Univ., Austin, TX (United States). Inst. for Fusion Studies); Cohen, R.H.; Ryutov, D.D.; Tsidulko, Y.A.; Xu, X.Q. Texas Univ., Austin, TX (United States). Inst. for Fusion Studies. Aug 1992. 42p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-80ET53088 ;W-7405-ENG-48 ;FG03-90ER54079. (IFSR–568). Order Number DE93000623. Source: OSTI; NTIS; INIS; GPO Dep.

An electron temperature instability driven by the Kunkel-Guillory sheath impedance, has been applied to the scrape-off layer of tokamaks. The formalism has been generalized to more fully account for parallel wavelength dynamics, to differentiate between electromagnetic and electrostatic perturbations and to account for particle recycling effects. It is conjectured that this conducting wall instability leads to edge fluctuations in tokamaks that produce scrape-off widths of many ion Larmor radii $\simeq$10. The predicted instability characteristics correlate somewhat with DIII-D edge fluctuation data, and the scrape-off layer width in the DIII-D experiment agrees with theoretical estimates that can be derived from mixing lenght theory.

2325 (DOE/ET/53088–570) **Correlation theory of a two-dimensional plasma turbulence with shear flow.** Zhang, Y.Z.; Mahajan, S.M. Texas Univ., Austin, TX (United States). Inst. for Fusion Studies. Sep 1992. 63p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-80ET53088. (IFSR–570). Order Number DE93000880. Source: OSTI; NTIS; INIS; GPO Dep.

When the ion sound effect is neglected, a wide class of electrostatic plasma turbulence can be modelled by a two-dimensional equation for the generalized exstrophy Ψ, an inviscid constant of motion along the turbulent orbits. Under the assumption of a Gaussian stochastic electrostatic potential, an averaged Green's function method is used to rigorously derive equations for the N-particle correlation functions for a dissipative and sheared flow. This approach is equivalent to the cumulant expansion method used to study the Vlasov-Poisson system. For various cases of interest, appropriate equations are solved to obtain the absolute level as well as the detailed structure of the two-point correlation function C(r), and its Fourier transform, the exstrophy spectral function I(k). Uniformly valid analytical expressions are derived for the dissipative but shearless case resulting in a 'fluctuation-dissipation' theorem relating the total spectral intensity to classical viscosity. These self-consistent results show a strong logarithmic modification of the mixing length estimates for the turbulence levels.

2326 (DOE/ET/53088–573) **Multiple-gap theory of toroidal Alfven waves with kinetic effects.** Zhang, X.D.; Zhang, Y.Z.; Mahajan, S.M. Texas Univ., Austin, TX (United States). Inst. for Fusion Studies. Sep 1992. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-80ET53088. (IFSR–573). Order Number DE93001852. Source: OSTI; NTIS; INIS; GPO Dep.

The stability of kinetic toroidal Alfven waves with multi-gap coupling is analyzed by using the two-dimensional ballooning transform. An alternate convergence scheme, based on the smallness of the inverse aspect ratio, is devised. The resulting wave functions are oscillatory and do not balloon in contrast to the wave functions of conventional ballooning theory. It is shown that the single-gap theory is a special, weak shear ($s \rightarrow 0$) limit of the formalism. Analytical and numerical results for the two fundamental branches, the ideal toroidal Alfven eigenmode (TAE), and the kinetic toroidal Alfven eigenmode (KTAE) are presented and discussed.

2327 (DOE/ET/53088–575) **A self-consistent turbulence generated scenario for L-H transition.** Zhang, Y.Z.; Mahajan, S.M. Texas Univ., Austin, TX (United States). Inst. for Fusion Studies. Oct 1992. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-80ET53088. (IFSR–575). Order Number DE93001853. Source: OSTI; NTIS; INIS; GPO Dep.

The turbulence-induced ion banana polarization current associated with steep ion temperature gradients is explored as a possible mechanism for generating poloidal momentum at the tokamak edge. In the light of a recently developed two-dimensional turbulence theory, one can obtain a simple closed expression relating this current (determined by turbulence levels) to the derivatives of the poloidal rotation speed. A self-consistent system, then, emerges, if we balance the turbulence-induced poloidal momentum with that dissipated by viscosity. Under suitable conditions this system may show a bifurcation controlled by a parameter dependent on temperature gradients. Both the bifurcation point, and the shear layer width are predicted for a prescribed flow in terms of a scale characterizing the nonlinearity of viscosity. The crucial relevance of the flow parity with the turbulence scenario is analyzed.

2328 (EUR-CEA-FC–1453) **Localised measurements of turbulence in the Tore Supra tokamak.** Devynck, P. (Association

Euratom-CEA, Centre d'Etudes de Cadarache, 13 - Saint-Paul-lez-Durance (France). Dept. de Recherches sur la Fusion Controlee); Garbet, X.; Laviron, C.; Payan, J.; Saha, S.K.; Gervais, F.; Hennequin, P.; Quemeneur, A.; Truc, A. Association Euratom-CEA, Centre d'Etudes de Cadarache, 13 - Saint-Paul-lez-Durance (France). Dept. de Recherches sur la Fusion Controlee. Apr 1992. 30p. Source: OSTI; NTIS (US Sales Only); INIS.

A collective infra-red laser scattering diagnostic has been installed on the TORE SUPRA tokamak for the measurement of plasma density fluctuations. For the range of wave numbers explored (3-15 cm^{-1}), the scattering angles are very weak (about 1 mrad). Consequently, the scattering signals are averaged along the whole observation chord, resulting in poor longitudinal spatial localisation. However, by virtue of the pitch angle variation of the magnetic field lines in the tokamak, and of the perpendicularity of the turbulence wave vector to these field lines, it has been possible to obtain partial spatial resolution along the direction of the beam. Good agreement between the experimental and theoretical angular resolution of the diagnostic as well as the results of cross-correlation performed on the signals obtained by two simultaneous probing beams also justify this novel concept. From the variation of the fluctuation power with the orientation angle of the observed wave sector, it has been possible to deduce the radial fluctuation profile by a deconvolution procedure, showing that the fluctuations increase sharply near the edge. The k-spectrum was also measured and shows a k^{-3} dependence for $k>6$ cm^{-1}. Experimental evidences are put forward to show that the k-spectrum is neither purely poloidal nor purely radial in the (k_r-k_θ) plane.

2329 (FRCEA-TH–365) **Anomalous energy transport in hot plasmas: solar corona and Tokamak.** Beaufume, P. CEA Centre d'Etudes de Cadarache, 13 - Saint-Paul-lez-Durance (France); Ecole Centrale des Arts et Manufactures, 92 - Chatenay-Malabry (France). Apr 1992. 228p. (In French). Order Number DE93721057. Source: OSTI; NTIS (US Sales Only); INIS.

Anomalous energy transport is studied in two hot plasmas and appears to be associated with a heating of the solar corona and with a plasma deconfining process in tokamaks. The magnetic structure is shown to play a fundamental role in this phenomenon through small scale instabilities which are modelized by means of a nonlinear dynamical system: the Beasts' Model. Four behavior classes are found for this system, which are automatically classified in the parameter space thanks to a neural network. We use a compilation of experimental results relative to the solar corona to discuss current-based heating processes. We find that a simple Joule effect cannot provide the required heating rates, and therefore propose a dimensional model involving a resistive reconnective instability which leads to an efficient and discontinuous heating mechanism. Results are in good agreement with the observations. We give an analytical expression for a diffusion coefficient in tokamaks when magnetic turbulence is perturbing the topology, which we validate thanks to the standard mapping. A realistic version of the Beasts' Model allows to test a candidate to anomalous transport: the thermal filamentation instability.

2330 (GA-A–21003) **Current drive with fast waves, electron cyclotron waves, and neutral injection in the DIII-D tokamak.** Prater, R. (General Atomics, San Diego, CA (United States)); Petty, C.C.; Pinsker, R.I.; Chiu, S.C.; deGrassie, J.S.; Harvey, R.W.; Ikel, H.; Lin-Liu, Y.R.; Luce, T.C.; James, R.A.; Porkolab, M.; Baity, F.W.; Goulding, R.H.; Hoffmann, D.J.; Kawashima, H. General Atomics, San Diego, CA (United States). Sep 1992. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-89ER51114 ;AC02-78ET51013 ;AC02-76CH03073 ;AC05-84OR21400. (CONF-920717–5: Topical conference meeting on radio frequency heating and current drive of fusion devices, Brussels (Belgium), 7-10 Jul 1992). Order Number DE93001359. Source: OSTI; NTIS; INIS; GPO Dep.

Current drive experiments have been performed on the DIII-D tokamak using fast waves, electron cyclotron waves, and neutral injection. Fast wave experiments were performed using a 4-strap antenna with 1 MW of power at 60 MHz. These experiments showed effective heating of electrons, with a global heating efficiency equivalent to that of neutral injection even when the single pass damping was calculated to be as small as 5%. The damping was probably due to the effect of multiple passes of the wave through the plasma. Fast wave current drive experiments were performed with a toroidally directional phasing of the antenna straps. Currents driven by fast wave current drive (FWCD) in the direction of the main plasma current of up to 100 kA were found, not including a calculated 40 kA of bootstrap current. Experiments with FWCD in the counter current direction showed little current drive. In both cases, changes in the sawtooth behavior and the internal inductance qualitatively support the measurement of FWCD. Experiments on electron cyclotron current drive have shown that 100 kA of current can be driven by 1 MW of power at 60 GHz. Calculations with a Fokker-Planck code show that electron cyclotron current drive (ECCD) can be well predicted when the effects of electron trapping and of the residual electric field are included. Experiments on driving current with neutral injection showed that effective current drive could be obtained and discharges with full current drive were demonstrated. Interestingly, all of these methods of current drive had about the same efficiency, 0.015×10^{20} MA/MW/m^2.

2331 (IC–92/157) **Intuitive approach to modified gyrokinetic equation and numerical confirmation.** Chen, C.Y.; Mahajan, S.M. International Centre for Theoretical Physics, Trieste (Italy). Jul 1992. 11p. Order Number DE93604671. Source: OSTI; NTIS (US Sales Only); INIS.

It has been revealed in a recent paper that although the gyrokinetic equation based on separating the total perturbed distribution function into adiabatic and nonadiabatic parts is accepted as a standard approach, the method has substantial problems, i.e., the theory is inherently gauge-dependent and suffers some conceptual difficulties. In this paper, we propose an intuitive approach to modify the standard theory. The approach may help to put the problem in clearer perspective. Each term of the standard gyrokinetic equation is analyzed in light of its physical and mathematical implication, and then corresponding modification follows from suitable arguments. In particular, it is argued that gyrating particles in a magnetized plasma cannot adibatically respond to a perpendicular wave-like field so that the "adiabatic" terms in the equation should be treated equally with other terms and should be gyro-averaged to make the gyrokinetic effect emerge. It is motivated that as many as possible heuristic arguments can be discussed in the paper. After establishing the modified gyrokinetic equation, we verify our approach numerically with the code developed on the Runge-Kutta algorithm. (author). 5 refs, 3 figs.

2332 (IC–92/159) **Are there missing convective currents?.** Chen, C.Y. International Centre for Theoretical Physics, Trieste (Italy). 1992. 7p. Order Number DE93604672. Source: OSTI; NTIS (US Sales Only); INIS.

It is revealed in this letter that as far as distribution functions obtained from gyrokinetic equations are concerned, the standard formulae to evaluate currents in plasmas are not applicable due to the fact that those distribution functions are given in a moving coordinate frame and the moving is essentially related to perturbed fields. With heuristic and analytic approaches, appropriate formulae are obtained to evaluate several types of currents in plasmas of which some have been missing in previous approaches. (author). 6 refs, 1 fig.

2333 (INIS-BR–2933, pp. 377) **Plasma parameters produced by DC thermoionic discharge with magnetic confinement.** Massi, M. (Centro Tecnico Aeroespacial, Sao Jose dos Campos, SP (Brazil). Inst. Tecnologico de Aeronautica); Thomas Junior, J.C.; Sudano, J.P.; Maciel, H.S. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. MAGNETIC CONFINEMENT/ plasma diagnostics; PLASMA DIAGNOSTICS/magnetic confinement; ELECTRIC CONDUCTIVITY; ELECTRIC DISCHARGES; ELECTRON TEMPERATURE; LANGMUIR PROBE; MAGNETIC FIELDS; PLASMA DENSITY; PLASMA POTENTIAL; TUNGSTEN

2334 (INIS-mf–13349, pp. 26-27) **Calculating loss of emittance of stellarator; using neoclassic transport theory.**

Namdar, A. (Teacher Trainee Univ. of Tabriz (Iran, Islamic Republic of)); Sobhanian, S. Iranian Physics Society, Teheran (Iran, Islamic Republic of). 1991. 53p. (In Persian). (CONF-9109417–: Iran's physics conference, Isfahan (Iran, Islamic Republic of), 10 Sep 1991). In *Abstract of articles from Iran's physics conference.* Order Number DE93000811. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. STELLARATORS/emissivity; ELECTRON CYCLOTRON-RESONANCE; NEOCLASSICAL TRANSPORT THEORY; PLASMA; POWER LOSSES; STELLARATORS; EMISSIVITY

2335 (INIS-mf–13349, pp. 27) **Solution of wave field equations in plasma.** Sheikhol Islami Sabzeivari, B. (Duesseldorf Univ. (Germany)). Iranian Physics Society, Teheran (Iran, Islamic Republic of). 1991. 53p. (In Persian). (CONF-9109417–: Iran's physics conference, Isfahan (Iran, Islamic Republic of), 10 Sep 1991). In *Abstract of articles from Iran's physics conference.* Order Number DE93000811. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. FIELD EQUATIONS/plasma; EIGENVECTORS; PLASMA; MAXWELL EQUATIONS

2336 (INIS-mf–13361) **Plasma physics network newsletter. No. 5.** International Atomic Energy Agency, Vienna (Austria). Aug 1992 5p. Order Number DE93606216. Source: OSTI; NTIS (US Sales Only); INIS.

Hard copies are available from IAEA, Physics Section.

The fifth Plasma Physics Network Newsletter (IAEA, Vienna, August 1992) includes the following topics: (i) the availability of a list of the members of the Third World Plasma Research Network (TWPRN); (ii) the announcement of the fourteenth IAEA International Conference on Plasma Physics and Controlled Nuclear Fusion Research to be held in Wuerzburg, Germany, from September 30 to October 7, 1992; (iii) the announcement of a Technical Committee Meeting on research using small tokamaks, organized by the IAEA as a satellite meeting to the aforementioned fusion conference; (iv) IAEA Fellowships and Scientific Visits for the use of workers in developing member states, and for which plasma researchers are encouraged to apply through Dr. D. Banner, Head, Physics Section, IAEA, P.O. Box 100, A-1400 Vienna, Austria; (v) the initiation in 1993 of a new Coordinated Research Programme (CRP) on "Development of Software for Numerical Simulation and Data Processing in Fusion Energy Research", as well as a proposed CRP on "Fusion Research in Developing Countries using Middle- and Small-Scale Plasma Devices"; (vi) support from the International Centre for Theoretical Physics (ICTP) for meetings held in Third World countries; (vii) a report by W. Usada on Fusion Research in Indonesia; (viii) News on ITER; (ix) the Technical Committee Meeting planned September 8-12, 1992, Canada, on Tokamak Plasma Biasing; (x) software made available for the study of tokamak transport; (xi) the electronic mail address of the TWPRN; (xii) and the FAX, e-mail and postal address for contributions to this plasma physics network newsletter (FAX: (43-1)-234564).

2337 (IYaF–91-66) **Measurements of the energy spectrum of an intense microsecond relativistic electron beam in the beam-plasma experiments using a multi-foil analyzer.** Knyazev, B.A.; Mel'nikov, P.I.; Nikiforov, A.A.; Chikunov, V.V. AN SSSR, Novosibirsk (Russian Federation). Inst. Yadernoj Fiziki. 1991. 37p. (In Russian). Order Number DE93606271. Source: OSTI; NTIS (US Sales Only); INIS.

Energy spectra of a 1 MeV, 70 kA, 4μs, 140 kJ relativistic electron beam (REB) on the U1-SPIN device are measured before and after passing through gas/plasma prefilled drift chamber using multifoil analyzer. The drift chamber is a 1-long, 10 cm diameter stainless steel tube with 4T longitudinal magnetic field. The initial beam injected to the tube from the accelerator diode is monoenergetic. For high gas densities ($\approx 10^{16} cm^{-3}$) the energy spectrum on the exit of the tube remains the same as it is the diode. If the gas/plasma density is less then $10^{15} cm^{-3}$ the energy loss up to 20% is observed. At the initiak gas density about $10^{13} cm^{-3}$ appreciable fraction ($\approx$10%) of the beam electrons with the energy more than initial one appears. Specific features of the diagnostic technique are discussed in details. 21 refs.; 15 figs.

2338 (IYaF–91-68) **Experimental MHD stability limit in the gas-dynamic trap.** Bagryanskij, P.A. (and others); Ivanov, A.A.; Karpushov, A.N. AN SSSR, Novosibirsk (Russian Federation). Inst. Yadernoj Fiziki. 1991. 14p. Order Number DE93606218. Source: OSTI; NTIS (US Sales Only); INIS.

This paper summarizes the results of extensive experimental investigations of a plasma MHD stability in gas-dynamic trap GDT, which have been carried out over past 3 years at Novosibirsk. The objective of the experiments reported was to give experimental evidence of plasma stability in GDT and compare the conditions, under which it would be achieved, with the theoretical predictions. It was found that theoretical predictions generally agree with the measurements with only one notable exception, namely the limit in the mirror ratio for the plasma stability. This observation is discussed in detail. 12 refs.; 5 figs.

2339 (IYaF–91-102) **Analysis of possibilities for using laser scattering for MeV electron beam diagnostics.** Arzhannikov, A.V. AN SSSR, Novosibirsk (Russian Federation). Inst. Yadernoj Fiziki. 1991. 24p. (In Russian). Order Number DE93606223. Source: OSTI; NTIS (US Sales Only); INIS.

Analysis of a possibility of measuring the longitudinal speed spread of MeV electrons by laser scattering is performed. The choice of the wave length and the power of an initial laser beam as well as its incidence angle to the beam and scattered radiation detection angle is discussed therewith. Shapes of spectra of radiation scattered on the beams with different distribution function are presented and effect of movement of electrons in intrinsic beam fields on them is discussed. 17 refs.; 9 figs.

2340 (IYaF–91-106) **Analyzer of energy spectra of a magnetized relativistic electron beam.** Voropaev, S.G.; Deulin, Yu.I.; Karyukin, A.V.; Lebedev, S.V.; Shcheglov, M.A. AN SSSR, Novosibirsk (Russian Federation). Inst. Yadernoj Fiziki. 1991. 15p. (In Russian). Order Number DE93606224. Source: OSTI; NTIS (US Sales Only); INIS.

Analyzer of magnetized REB instant energy spectrum is described. The analyzer operation principle is based on the application of a sharp change of the direction of force lines of a magnetic field which is non-adiabatic for the beam electrons. The analyzer design is described, the main factors effecting the energy resolution are considered. The analyzer serviceability is examined in the course of experiments on plasma heating using a heavy-current microsecond REB at the GOL-3 device. The analyzer energy resolution which does not exceed 10% at 0.8 MeV energy and 20% at 0.3 MeV is determined. Beam energy spectra are obtained in one of the regimes of beam interaction with plasma. The efficiency of beam interaction with plasma determined using the analyzer achieves 30%. 10 refs.; 7 figs.

2341 (LRP–456/92, pp. 25) **Linear MHD stability computations in 3D plasmas.** Cooper, W.A. (Ecole Polytechnique Federale, Lausanne (Switzerland). Centre de Recherche en Physique des Plasma (CRPP)); Nakamura, Y.; Wakatani, M.; Gruber, R.; Merazzi, S.; Anderson, D.V.; Schwenn, U. Ecole Polytechnique Federale, Lausanne (Switzerland). Centre de Recherche en Physique des Plasma (CRPP). May 1992. (CONF-920610–: 14. international conference on plasma and 19th EPS conference on controlled fusion and plasma physics, Innsbruck (Austria), 29 Jun - 3 jul 1992). In *Papers contributed to the 19. EPS conference on controlled fusion and plasma physics.* vp. Order Number DE93000810. Source: OSTI; NTIS; INIS.

The critical β value as a function of the inverse number of coils is shown for cases in which the plasma-coil gap is 20, 30, 40 and 50 cm. With 32 coils, the β value is virtually unaltered when the coil plasma distance exceeds 30 cm. With 16 coils, the critical β degrades when the gap is smaller than 40 cm. (author) 2 figs., 9 refs.

2342 (LRP–456/92, pp. 25) **Observation of two wave induced chaos in a magnetized plasma.** Fasoli, A. (Ecole Polytechnique Federale, Lausanne (Switzerland). Centre de Recherche en Physique des Plasma (CRPP)); Paris, P.J.; Tran, M.Q.; Skiff, F. Ecole Polytechnique Federale, Lausanne (Switzerland). Centre de Recherche en Physique des Plasma (CRPP). May 1992. (CONF-920610–: 14. international conference on plasma and 19th EPS conference on controlled fusion and plasma physics, Innsbruck (Austria), 29 Jun - 3 jul 1992). In *Papers contributed to the 19. EPS conference on controlled fusion and plasma physics.* vp. Order Number DE93000810. Source: OSTI; NTIS; INIS.

The problem of wave induced stochasticity in plasmas is being studied extensively because of its general interest in chaotic dynamics and of its possible direct consequences in space and laboratory plasmas, such as anomalous transport and non-linear heating and particle acceleration. In our experiment we investigate the interaction between ions and two propagating electrostatic modes in a Q-machine plasma. In particular, our aim is to perform and integrate observations of the collective ion response (wave characteristics), of ion kinetic features (modification of the distribution functions, time scale for heating) and of single particle orbit modifications (phase space transport). (author) 4 figs., 8 refs.

2343 (LRP–456/92, pp. 25) **Nonlinear mechanism for the suppression of error field magnetic islands by plasma flow.** Parker, R.D. (Ecole Polytechnique Federale, Lausanne (Switzerland). Centre de Recherche en Physique des Plasma (CRPP)). Ecole Polytechnique Federale, Lausanne (Switzerland). Centre de Recherche en Physique des Plasma (CRPP). May 1992. (CONF-920610–: 14. international conference on plasma and 19th EPS conference on controlled fusion and plasma physics, Innsbruck (Austria), 29 Jun - 3 jul 1992). In *Papers contributed to the 19. EPS conference on controlled fusion and plasma physics.* vp. Order Number DE93000810. Source: OSTI; NTIS; INIS.

Non-axisymmetric magnetic field perturbations generated, for example, by errors in the alignment of the field coils are known to lead to reduced confinement in a tokamak. By inducing the formation of small, stationary, magnetic islands on all rational surfaces they can enhance radial transport and under certain circumstances interact with MHD instabilities to trigger the onset of locked modes leading, in some cases, to disruption of the plasma discharge. Given the stationary nature of the error field islands it is natural to consider whether they can be reduced significantly by the viscous drag of a sheared flow resulting from a bulk rotation of the plasma. In this paper, we examine this interaction by modelling the nonlinear growth and saturation of force-reconnected magnetic islands driven by a corrugated boundary in a slab plasma with an initially uniform flow. A systematic parameter study is made of the time asymptotic steady state. (author) 3 figs., 5 refs.

2344 (PPPL–2858) **Neutron emission from TFTR supershots.** Strachan, J.D. (Princeton Univ., NJ (United States). Plasma Physics Lab.); Bell, M.G.; Bitter, M.; Budny, R.; Hawryluk, R.; Hill, K.W.; Hsuan, H.; Jassby, D.L.; Johnson, L.C.; LeBlanc, B.; Mansfield, D.; Meade, D.; Mikkelsen, D.R.; Mueller, D.; Park, H.; RPrinceton Univ., NJ (United States). Plasma Physics Lab. Oct 1992. 80p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03073. Order Number DE93002632. Source: OSTI; NTIS; INIS; GPO Dep.

Empirical scaling relations are deduced describing the neutron emission from TFTR supershots using a data base that includes all of the supershot plasmas (525) from the 1990 campaign. A physics-based scaling for the neutron emission is derived from the dependence of the central plasma parameters on machine settings and the energy confinement time. This scaling has been used to project the fusion rate for equivalent DT plasmas in TFTR, and to explore machine operation space which optimizes the fusion rate. Increases in neutron emission are possible by either increasing the toroidal magnetic field or further improving the limiter conditioning.

2345 (PPPL–2860) **Summary of the third workshop on alpha particle physics in TFTR.** Sigmar, D. (Massachusetts Inst. of Tech., Cambridge, MA (United States). Plasma Fusion Center); Young, K.M.; Zweben, S.J. Princeton Univ., NJ (United States). Plasma Physics Lab. Oct 1992. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03073. Order Number DE93002631. Source: OSTI; NTIS; INIS; GPO Dep.

This report summaries the experimental, theoretical, and diagnostic talks presented at the Third Workshop on Alpha Particle Physics in TFTR, which was held at MIT May 28–29, 1992.

2346 (PPPL–2861) **Quenching A-coefficients by photons in a short discharge tube.** Cao, H.; DiCicco, D.; Suckewer, S. Princeton Univ., NJ (United States). Plasma Physics Lab. Oct 1992. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03073. Order Number DE93002630. Source: OSTI; NTIS; INIS; GPO Dep.

New experimental results on quenching of A-coefficients by photons in a short discharge tube are presented. Experiments with the short discharge tube have eliminated questions related to the effects of absorption in a long laser tube, and have provided good confirmation of earlier results.

2347 (PPPL-TH–92-1) **Princeton University Plasma Physics Laboratory, Theory Division quarterly report, January 1–March 31, 1992.** Princeton Univ., NJ (United States). Plasma Physics Lab. [1992]. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03073. Order Number DE93002629. Source: OSTI; NTIS; GPO Dep.

This report discusses the following topics: High β MHD stability studies with PEST; and high β: Is it the Promised Land?

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Refer also to citation(s) 157, 2319

2348 (CEA-CONF–10980) **Electron cyclotron resonance sources of multicharged ions: state of the art, recent developments and prospects.** Melin, G.; Hitz, D.; Barue, C.; Bourg, F.; Briand, P.; Delaunay, M.; Geller, R.; Girard, A.; Jacquot, B.; Ludwig, P.; Pontonnier, M. CEA Centre d'Etudes de Grenoble, 38 (France). Dept. de Recherche Fondamentale sur la Matiere Condensee. 1992. 3p. (CONF-920315–: 3. European particle accelerator conference, Berlin (Germany), 24-28 Mar 1992). Order Number DE93721042. Source: OSTI; NTIS (US Sales Only); INIS.

The improvement of the Electron Cyclotron Resonance Ion Sources (ECRIS) essentially relies on the technology and the plasma physics. The main trends of efforts at Grenoble are: high magnetic field ECRIS, permanent magnet only built ECRIS, basic research on plasma physics involved in multicharged ion production. Here the recent results are discussed as well as the orientations and prospects.

2349 (CEA-CONF–10999) **European research and development programme for water-cooled lithium-lead blankets: present status and future work.** Giancarli, L. (CEA Centre d'Etudes de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Mecanique et de Technologie); Leroy, P.; Proust, E.; Raepsaet, X.; Barbier, F.; Flament, T.; Futterer, M.; Sannier, J.; Terlain, A.; Coen, V.; Perujo, A.; Sample, T.; BenaCEA Centre d'Etudes de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Mecanique et de Technologie. 1992. 6p. (CONF-920607–: 10. topical meeting on technology of fusion energy, Boston, MA (United States), 7-12 Jun 1992). Order Number DE93721108. Source: OSTI; NTIS (US Sales Only); INIS.

The European R and D programme in support of the development of water-cooled Pb-17Li blankets for DEMO aims at improving the data base concerning tritium behaviour and compatibility between blanket materials. The four main areas of the experimental programme are structural material corrosion by Pb-17Li, tritium extraction and permeation control.=, Pb-17Li physico-chemistry, and water/Pb-17Li interaction. This paper describes the most significant results obtained to date in the various experiments performed in Europe and the future programme required to complete the data base by 1994. 28 refs.

2350 (CEA-CONF–11000) **Water-cooled lithium-lead blanket design studies for Demo reactor: definition and recent developments of the box-shaped concept.** Giancarli, L. (CEA Centre d'Etudes de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Mecanique et de Technologie); Baraer, L.; Leroy, P.; Mercier, J.; Proust, E.; Severi, Y.; Quintric-Bossy, J. CEA Centre d'Etudes de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Mecanique et de Technologie. 1992. 8p. (CONF-920607–: 10. topical meeting on technology of fusion energy, Boston, MA (United States), 7-12 Jun 1992). Order Number DE93721109. Source: OSTI; NTIS (US Sales Only); INIS.

Within the framework of the European DEMO blanket study programme, this paper describes the design work performed on the 'box-shaped' concept for water-cooled Pl-17Li blankets in the past two years. The first part of the paper describes the general design, and the thermo-mechanical and neutronical analyses of the main segment structure leading to the optimization of the thickness of

the various component. The second part describes specific analysis of particular segment regions, like water- and Pb-17Li-headers, box bottom and support, which have required detailed design development. All results indicate that the 'box-shaped' concept is a very promising candidate for DEMO reactor blankets.

2351 (CEA-CONF–11001) **Experimental programme in support of the development of the European ceramic-breeder-inside-tube test-blanket: present status and future work.** Proust, E. (CEA Centre d'Etudes de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Mecanique et de Technologie); Roux, N.; Flament, T.; Anzidei, L.; Casadio, S. CEA Centre d'Etudes de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Mecanique et de Technologie. 1992. 10p. (CONF-920607–: 10. topical meeting on technology of fusion energy, Boston, MA (United States), 7-12 Jun 1992). Order Number DE93721110. Source: OSTI; NTIS (US Sales Only); INIS.

Four DEMO blanket classes are under investigation within the framework of the European Test-Blanket Development Programme. One of them is featured by the use of lithium ceramic breeder pellets contained inside externally helium cooled tubes. This paper summarizes the main achievements to date of the experimental programme supporting the development of this class of blanket. It also gives an outline of the areas of the breeder material, beryllium, tritium control, and thermomechanical tests, the future work envisaged for the 92-94 period. 53 refs.

2352 (CEA-CONF–11002) **Further adaptation of the European ceramic-B.I.T. blanket conceptual design to updated Demo specifications.** Proust, E. (CEA Centre d'Etudes de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Mecanique et de Technologie); Szczepanski, J.; Bielak, B. CEA Centre d'Etudes de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Mecanique et de Technologie. 1992. 7p. (CONF-920607–: 10. topical meeting on technology of fusion energy, Boston, MA (United States), 7-12 Jun 1992). Order Number DE93721111. Source: OSTI; NTIS (US Sales Only); INIS.

This paper presents the recent development studies on the adaptation of the European Ceramic Solid Breeder Inside Tube (BIT) Blanket to updated DEMO specifications. The adaptation work is in progress, since 1990, when a detailed comparison between two existing designs lead to the selection of an unique concept. The main new developments concern the separation in two parts of the inboard blanket segments at the level of the lower divertor, the consequent improvement of the blanket coverage, the simplification of maintenance operations, and finally the increased compactness of the blanket because of the inclusion of the shielding into the breeder assembly.

2353 (CEA-N–2692) **Effect of induced spatial incoherence on parametric instabilities.** Bourdier, A. (CEA Centre d'Etudes de Limeil, 94 - Villeneuve-Saint-Georges (France)); Pesme, D.; Bortuzzo-Lesne; Berger, R.L.; Williams, E.A. CEA Centre d'Etudes de Limeil, 94 - Villeneuve-Saint-Georges (France). 1992. 107p. (In French). Order Number DE93721711. Source: OSTI; NTIS (US Sales Only); INIS.

The effect on parametric instability growth of pump wave incoherence is treated by deriving a set of equations governing the space-time evolution of the ensemble-average coupled-mode amplitudes and intensities. Particular attention is paid to establishing the regions of validity of the statistical description. Thresholds, growth rates, and amplification rates are given for both spatially and temporally incoherent pump waves. Both absolutely and convectively unstable modes are considered. The statistical results are verified where appropriate by numerical integration of the coupled-mode equations with different models of pump incoherence.

2354 (CFFTP-G–8906) **UTIAS tritium exposure facility for fusion materials studies.** Youle, I.S. (Toronto Univ., ON (Canada). Inst. for Aerospace Studies); Haasz, A.A. Canadian Fusion Fuels Technology Project, Toronto, ON (Canada). Jul 1989. 25p. Order Number DE93604728. Source: OSTI; NTIS (US Sales Only); INIS.

A low-level tritium facility, directed at fusion materials research, was built at UTIAS. The facility consists of a bakeable uhv system housed in a continuously ventilated glove box. The system is totally oil-free, and is pumped by a combination of cryosorption, cryocondensation and getter pumps. Test specimens are studied under molecular or atomic tritium exposure. Experiments to date have been focussed on studies of chemical erosion of carbon, tritium retention and diffusion in graphite.

2355 (CFFTP-G–9028) **ITER isotope separation system: Alternative distributed ISS design study - Revision 0.** Busigin, A. (Ontario Hydro, Toronto, ON (Canada)); Sood, S.K.; Kveton, O.K.; Sherman, R.H.; Anderson, J.L. Canadian Fusion Fuels Technology Project, Toronto, ON (Canada). Sep 1990. 27p. (ITER-IL-FC–9.2-0-31.). Order Number DE93604737. Source: OSTI; NTIS (US Sales Only); INIS.

This document presents the results of a study that examined the technical operating and economic viability of an alternative Isotope Separation System (ISS) design based on the distributed design concept. In the distributed design, the ISS is broken up into local independently operable subsystems matched to local processing requirements. The distributed design accepts the same feeds and produces essentially the same products as the reference design. The distributed design consists of two separate, independent subsystems. The first, called ISS-H, receives only protium-dominated streams and waste water from tritium extraction. It has two cryogenic distillation columns and can produce a 50 percent D, 50 percent T product since it lacks D/T separation capability. A final 80 percent T_2 concentration product can be obtained by blending the 50 percent T_2 stream from ISS-H with the more than 99 percent T_2 stream from the second subsystem, ISS-D. The second subsystem receives only deuterium-dominated feeds, which also contain some protium. ISS-D is as complex as the reference design, but smaller. Although each subsystem has some advantages, such as only two cryogenic distillation columns in ISS-H and better than 99 percent steady state T_2 product in ISS-D, the combined subsystems do not offer any real advantage compared to the reference IISS. The entire distributed ISS design has been simulated using Ontario Hydro's FLOSHEET steady state process simulator. Dynamic analysis has not been done for the distributed design. (10 refs., 3 figs., 8 tabs.).

2356 (CFFTP-G–9091) **ITER fuel cycle systems: Cost estimation review - revision 1.0.** Kveton, O.K. Canadian Fusion Fuels Technology Project, Toronto, ON (Canada). Nov 1990. 26p. (ITER-IL-FC–2.9-0-76.). Order Number DE93604738. Source: OSTI; NTIS (US Sales Only); INIS.

This document records the assumptions under which the ITER Fuel Systems cost estimates were prepared. These are order of magnitude estimates, obtained without flow sheet or detailed equipment analysis by applying factors, ratios, and escalation to the known cost of an installation considered to be similar. The estimates include equipment and installation costs for each component. (5 figs., 16 refs.).

2357 (CFFTP-G–9092) **ITER fuel cycle systems: Energy requirements - Revision 0.0.** Kveton, O.K. Canadian Fusion Fuels Technology Project, Toronto, ON (Canada). Nov 1990. 13p. (ITER-IL-FC–9.5.1-0-47.). Order Number DE93604739. Source: OSTI; NTIS (US Sales Only); INIS.

This document identifies the primary sources of power requirements, and records the assumptions under which the Fuel Systems power consumption was estimated and balanced. (2 tabs., 15 refs.).

2358 (CONF-920146–6) **Fracture toughness measurements with subsize disk compact specimens.** Alexander, D.J. Oak Ridge National Lab., TN (United States). [1992]. 28p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From ASTM international symposium on small specimen test techniques and their applications to nuclear reactor vessel thermal annealing and plant life extension; New Orleans, LA (United States); 29-31 Jan 1992. Order Number DE93001374. Source: OSTI; NTIS; INIS; GPO Dep.

Special fixtures and test methods have been developed for testing small disk compact specimens (12.5 mm diam by 4.6 mm thick). Both unloading compliance and potential drop methods have been used to monitor crack extension during the J-integral resistance (J-R) curve testing. Provisions have been made to allow the necessary probes and instrumentation to be installed remotely using manipulators for testing of irradiated specimens in a hat cell. Laboratory trials showed that both unloading compliance and potential drop gave useful results. Both techniques gave similar data,

and predicted the final crack extension within allowable limits. The results from the small disk compact specimens were similar to results from conventional compact specimens 12.7-mm thick. However, the slopes of the J-R curves from the larger specimens were lower, suggesting that the smaller disk compact specimens may have lost some constraint due to their size. The testing shows that it should be possible to generate useful J-R curve fracture toughness data from the small disk compact specimens.

2359 (CONF-920930–10) **ORNL centrifuge pellet fueling system.** Foster, C.A. (Oak Ridge National Lab., TN (United States)); Houlberg, W.A.; Gouge, M.J.; Grapperhaus, M.J.; Milora, S.L.; Drawin, H.; Geraud, A.; Chatelier, M.; Gros, G. Oak Ridge National Lab., TN (United States). [1992]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 17. symposium on fusion technology; Rome (Italy); 14-18 Sep 1992. Order Number DE93001362. Source: OSTI; NTIS; INIS; GPO Dep.

A centrifuge pellet injecter designed and built at Oak Ridge National Laboratory (ORNL) is in operation on Tore Supra. This injector has the capability of injecting up to 100 pellets at speeds up to 800 M/s. The solid deuterium pellets can be formed with a variable mass from 3 to 10 torr-L and are fired at a rate of up to 10 pellets per second. The experimental program that is under way combines repetitive pellet fueling with the ergodic divertor and pump limiters to establish and understand long-pulse plasmas in which the pellet fuel source is in balance with the particle exhaust. With lower hybrid current drive, pulse lengths of up to 2 min might be achieved. To prepare for these extended pulse lengths, the pellet source on the centrifuge will be extended to provide a 300- to 500-pellet capability. A similar system extended to steady-state pellet fabrication technology and designed for a radiation and tritium environment would be a candidate for a fueling system for the International Thermonuclear Experimental Reactor (ITER). Analysis of pellet-fueled ITER discharges using the WHIST code shows the potential for controlling the radial fuel deposition point to achieve the desired core density while maintaining the edge density and temperatures so as to minimize the diverter plate erosion. A centrifuge fueling system would have the capability of taking the D-T exhaust directly from the cryopumping systems, recondensing and purifying the fuel, and injecting the reconstituted pellets into the plasma, thereby minimizing the tritium inventory.

2360 (CONF-920930–11) **High-speed repetitive pellet injector prototype for magnetic confinement fusion devices.** Frattolillo, A. (Associazione EURATOM-ENEA per la fusion, Frascati (Italy)); Gasparotto, M.; Migliori, S.; Angelone, G.; Baldarelli, M.; Scaramuzzi, F.; Ronci, G.; Combs, S.K.; Milora, S.L.; Foust, C.R.; Gouge, M.J.; Reggiori, A.; Riva, G.; Carlevaro, R.;.Oak Ridge National Lab., TN (United States). [1992]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 17. symposium on fusion technology; Rome (Italy); 14-18 Sep 1992. Order Number DE93001361. Source: OSTI; NTIS; INIS; GPO Dep.

The design of a test facility aimed at demonstrating the feasibility of high-speed repetitive acceleration of solid D_2 pellets for fusion applications, developed in a collaboration between Oak Ridge National Laboratory and ENEA Frascati, is presented. The results of tests performed at the CNPM/CNR on the piston wear in a repetitively operating two-stage gun are also reported.

2361 (DOE/ER/53198–205) **B_4C solid target boronization of the MST reversed-field pinch.** Den Hartog, D.J.; Cekic, M.; Fiksel, G.; Hokin, S.A.; Kendrick, R.D.; Prager, S.C.; Stoneking, M.R. Wisconsin Univ., Madison, WI (United States). Dept. of Physics. Oct 1992. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-85ER53198. Order Number DE93002736. Source: OSTI; NTIS; INIS; GPO Dep.

A solid rod of hot-pressed boron carbide is being used as the source of boron during boronization of MST. The most striking result of this procedure is the reduction in oxygen contamination of the plasma (O III radiation, characteristic of oxygen at the edge, falls by about a factor of 3 after boronization.). The radiated power fraction drops to about half its initial value. Particle reflux from the wall is also lowered, making density control simpler. The rod (12.7 mm diameter) is inserted into the edge plasma of normal high-power RFP discharges. B_4C is ablated from the surface of the rod and deposited in a thin film (a-B/C:H) on the walls and limiters. The energy flux carried by "superthermal" (not "runaway") electrons at the edge of MST appears to enhance the efficient, non-destructive ablation of the boron carbide rod.

2362 (ECN-RX–91-074) **High emissivity TiC coatings for a first wall: Presented at the Second International Symposium on Fusion Nuclear Technology, June 2-7, 1991, Karlsruhe, Germany.** Groot, P. (Nationaal Inst. voor Kernfysica en Hoge-Energiefysica (NIKHEF), Amsterdam (Netherlands). Sectie H); Dvorak, M. Netherlands Energy Research Foundation (ECN), Petten (Netherlands). Aug 1991. 10p. (CONF-9106310–: 2. international symposium on fusion nuclear technology and exposition, Karlsruhe (Germany), 2-7 Jun 1991). Order Number DE93604740. Source: OSTI; NTIS; INIS.

Submitted for publication in: Fusion Engineering and Design.

Part of the First Wall of the conceptual design of Next European Torus NET consist of radiation cooled carbon tiles. Tile temperature is determined by the optical properties of facing surfaces. Heat transfer to the 316 stainless steel structure can be improved by applying a high emissivity coating. For this purpose ceramic coatings can be applied. This paper deals with development and characterization of atmospheric and vacuum plasma sprayed titanium carbide as high emissivity coatings. Microstructural evaluation of these coatings includes X-ray diffraction and light microscopy of cross-sections. Total emissivities of vacuum and atmospheric plasma sprayed TiC coatings were measured at 525 K at PTB Braunschweig. Reflection measurements were performed at ECN Petten by using a YAG laser with wavelength 1.06 μm at room temperature. The effects of compositional differences on optical properties are discussed. (author). 9 refs.; 5 figs.; 1 tab.

2363 (EUR–14028) **Numerical analysis and nuclear standard code application to thermal fatigue.** Merola, M. (Commission of the European Communities, Ispra (Italy). Joint Research Centre). Commission of the European Communities, Luxembourg (Luxembourg). 1992. 43p. Source: OSTI; NTIS (US Sales Only); INIS.

The present work describes the Joint Research Centre Ispra contribution to the IAEA benchmark exercise 'Lifetime Behaviour of the First Wall of Fusion Machines'. The results of the numerical analysis of the reference thermal fatigue experiment are presented. Then a discussion on the numerical analysis of thermal stress is tackled, pointing out its particular aspects in view of their influence on the stress field evaluation. As far as the design-allowable number of cycles are concerned the American nuclear code ASME and the French code RCC-MR are applied and the reasons for the different results obtained are investigated. As regards a realistic fatigue lifetime evaluation, the main problems to be solved are brought out. This work, is intended as a preliminary basis for a discussion focusing on the main characteristics of the thermal fatigue problem from both a numerical and a lifetime assessment point of view. In fact the present margin of discretion left to the analyst may cause undue discrepancies in the results obtained. A sensitivity analysis of the main parameters involved is desirable and more precise design procedures should be stated.

2364 (EUR–14434/1) **JET Joint Undertaking. Progress report 1991 - volume 1.** Commission of the European Communities, Luxembourg (Luxembourg). Apr 1992. 207p. Source: OSTI; NTIS (US Sales Only); INIS.

The ninth JET Progress Report provides an overview summary and puts into context the scientific and technical advances made on JET during 1991. The report contains a brief summary of the background to the project, and describes the basic objectives of JET and the principal design aspects of the machine.

2365 (EUR–14434/2) **Jet Joint Undertaking. Progress report 1991 - volume 2.** Commission of the European Communities, Luxembourg (Luxembourg). Apr 1992. 314p. Source: OSTI; NTIS (US Sales Only); INIS.

This volume is an appendix of vol. 1 and contains selected articles prepared by JET authors providing some details of the activities and achievements made on JET during 1991.

2366 (EUR-CEA-FC–1447) **Quasi-optical concepts for lower hybrid waves launchers on large tokamaks.** Bibet, P.; Crenn, J.P. Association Euratom-CEA, Centre d'Etudes de Cadarache, 13 - Saint-Paul-lez-Durance (France). Dept. de Recherches sur la Fusion Controlee. Jan 1992. 60p. Source: OSTI; NTIS (US Sales Only); INIS.

New types of antennas, based on quasi-optical propagation, are considered for heating large Tokamaks (JET, ITER) at the lower hybrid frequency. The use of quasi-optical techniques in these antennas allows to compete with waveguides used up to now. Two types of LHW launchers are studied in which the radiating antenna is associated to a grill composed of either a waveguide array or a diffraction rod array. The first type leads to low power transmission values. In the second type, Gaussian beams are launched by radiating antenna in order to have a smaller angle of divergence improving the emission. More thorough theoretical and experimental studies are needed, to make this concept more precise and to compare it to LHW launchers based strictly on waveguide concept.

2367 (EUR-CEA-FC–1451) **Optical visualization of electric and magnetic field perturbations in tokamak discharges by hydrogen pellet injection.** Drawin, H.W.; Dubois, M.A. Association Euratom-CEA, Centre d'Etudes de Cadarache, 13 - Saint-Paul-lez-Durance (France). Dept. de Recherches sur la Fusion Controlee. Apr 1992. 21p. Source: OSTI; NTIS (US Sales Only); INIS.

Two-dimensional intensity distribution mappings of photographs of pellet ablation cloud trajectories in the TFR and TS tokamaks reveal irregular shapes of the luminous striations. The observed features are not well understood, but can be described and interpreted as the first direct visual observation of pre-existing electric and/or magnetic field perturbations in the hot core of tokamak plasmas. It is suggested to use pellet injection as a diagnostic tool for the study of plasma structures and transport phenomena.

2368 (EUR-CEA-FC–1452) **The effect of the ergodic divertor on electron thermal confinement.** Harris, G.R.; Capes, H.; Garbet, X. Association Euratom-CEA, Centre d'Etudes de Cadarache, 13 - Saint-Paul-lez-Durance (France). Dept. de Recherches sur la Fusion Controlee. Jun 1992. 23p. Source: OSTI; NTIS (US Sales Only); INIS.

The thermal confinement within the confinement zone of Tore Supra ohmically heated deuterium plasmas bounded by the ergodic divertor (ED) configuration is studied in a 1 1/2D analysis of the local power balance. Although the edge electron temperature and mean electron density (n_e) are both on average halved with application of the ED, the mean electron thermal diffusivity χ_e shows the same density dependence as exhibited by standard ohmic limiter discharges, i.e., an Alcator-like inverse dependence on (n_e) at low density and a saturation at high density. The ion thermal transport at low to medium densities in both limiter and ED discharges is between 10 to 20 times that predicted by neoclassical theory. Comparing ED and limiter plasmas of the same density, a strong plasma decontamination is observed, with a reduction, in Z_{eff} by between 1.0 to 1.5. The effective decoupling of (n_e) and Z_{eff} by the ED and the invariant behaviour of χ_e imply that electron thermal transport is only weakly dependent on Z_{eff} in ohmic Tore Supra discharges.

2369 (EUR-CEA-FC–1455) **Particle flux across a stochastic magnetic layer.** Samain, A.; Capes, H.; Ghendrih, P.; Nguyen, F. Association Euratom-CEA, Centre d'Etudes de Cadarache, 13 - Saint-Paul-lez-Durance (France). Dept. de Recherches sur la Fusion Controlee. May 1992. 17p. Source: OSTI; NTIS (US Sales Only); INIS.

The radial particle transport is considered in a plasma with ergodic and stochastic flux lines. The self consistent electric field is neglected and the particle flux is due to a succession of mass convections along flux lines in series with transverse diffusions at very small scale between neighbouring flux lines. We investigate the dependence of the average radial flux in terms of the thermodynamic forces, namely the pressure gradient which controls the parallel convection and the density gradient which controls the small scale transverse diffusion. The condition for which the average radial flux is driven by the average pressure or density gradient is derived.

2370 (EUR-CEA-FC–1456) **Plasma surface interactions in controlled fusion devices.** Association Euratom-CEA, Centre d'Etudes de Cadarache, 13 - Saint-Paul-lez-Durance (France). Dept. de Recherches sur la Fusion Controlee. 1992. 141p. (CONF-920311–: 10. international conference on plasma-surface interactions in controlled fusion devices, Monterey, CA (United States), 30 Mar - 3 apr 1992). Source: OSTI; NTIS (US Sales Only); INIS.

Separate abstracts were prepared for 8 papers of the conference.

2371 (EUR-CEA-FC–1456, pp. 1-34) **Transport in the plasma edge specific connection to the wall in the Tore Supra ergodic divertor experiments.** Grosman, A. (Association Euratom-CEA, Centre d'Etudes de Cadarache, 13 - Saint-Paul-lez-Durance (France). Dept. de Recherches sur la Fusion Controlee); Ghendrih, P.; DeMichelis, C.; Monier-Garbet, P.; Vallet, J.C.; Capes, H.; Chatelier, M.; Geraud, A.; GonAssociation Euratom-CEA, Centre d'Etudes de Cadarache, 13 - Saint-Paul-lez-Durance (France). Dept. de Recherches sur la Fusion Controlee. 1992. (CONF-920311–: 10. international conference on plasma-surface interactions in controlled fusion devices, Monterey, CA (United States), 30 Mar - 3 apr 1992). In *Plasma surface interactions in controlled fusion devices.* 141p. Order Number DE93721122. Source: OSTI; NTIS (US Sales Only); INIS.

The ergodic divertor experiments in TORE SUPRA can be analysed along two main lines. The first one refers to the change of the heat and particle transport in the ergodized zone. This is especially true for the electron heat transport which is enhanced in the edge layer. But other distinctive features give evidence of the importance of the parallel connexion length between the plasma edge and the wall. The field lines, which are stochastic in the major part of the perturbed layer (10-15 cm) are such that, in the outermost layer (3 cm), the connexion topology is regular. This has obvious effects on the particle and power deposition, but also on the plasma parameters, and consequently influences the particle recycling and impurity shielding processes. The TORE SUPRA ergodic divertor experiments are reviewed in this framework.

2372 (EUR-CEA-FC–1456, pp. 35-50) **Thermodesorption studies of boron doped graphite exposed to a low energy high density deuterium plasma.** Gauthier, E. (Association Euratom-CEA, Centre d'Etudes de Cadarache, 13 - Saint-Paul-lez-Durance (France). Dept. de Recherches sur la Fusion Controlee); Grisolia, C.; Fernandez, V.; Bardon, J. Association Euratom-CEA, Centre d'Etudes de Cadarache, 13 - Saint-Paul-lez-Durance (France). Dept. de Recherches sur la Fusion Controlee. 1992. (CONF-920311–: 10. international conference on plasma-surface interactions in controlled fusion devices, Monterey, CA (United States), 30 Mar - 3 apr 1992). In *Plasma surface interactions in controlled fusion devices.* 141p. Order Number DE93721122. Source: OSTI; NTIS (US Sales Only); INIS.

The thermodesorption of deuterium and some deuterocarbons from bulk boron doped carbon samples with different B/C ratios has been studied after exposure to a deuterium plasma. The ion bombarding energies were set between 50 eV and 260 eV. Increasing the boron content of the sample lowers the temperature of the maximum desorption rate and increases the amount of desorbed deuterium. These results are shown to be in agreement with recent studies by other authors in spite of the very different experimental conditions.

2373 (EUR-CEA-FC–1456, pp. 51-63) **Plasma wall particle balance in Tore Supra.** Grisolia, C. (Association Euratom-CEA, Centre d'Etudes de Cadarache, 13 - Saint-Paul-lez-Durance (France). Dept. de Recherches sur la Fusion Controlee); Ghendrih, P.; Pegourie, B.; Grosman, A. Association Euratom-CEA, Centre d'Etudes de Cadarache, 13 - Saint-Paul-lez-Durance (France). Dept. de Recherches sur la Fusion Controlee. 1992. (CONF-920311–: 10. international conference on plasma-surface interactions in controlled fusion devices, Monterey, CA (United States), 30 Mar - 3 apr 1992). In *Plasma surface interactions in controlled fusion devices.* 141p. Order Number DE93721122. Source: OSTI; NTIS (US Sales Only); INIS.

A comprehensive study of the particle balance between the carbon wall and the plasma is presented. One finds that the effective

particle content of the wall which governs the plasma equilibrium density departs from the deposited number of particles. This effect is dominant for the fully desaturated wall. A scaling law of the plasma density in terms of the wall effective particle content has been obtained. Moreover, the experimental data allows to estimate the plasma particle confinement time. Values ranging from 0.2 s to 0.5 s are found depending on the density. An analytical functional dependence of the particle confinement time is obtained.

2374 (EUR-CEA-FC–1456, pp. 64-80) **Boronization in Tore-Supra.** Gauthier, E. (Association Euratom-CEA, Centre d'Etudes de Cadarache, 13 - Saint-Paul-lez-Durance (France). Dept. de Recherches sur la Fusion Controlee); Grisolia, C.; Grosman, A.; Hess, W.; Hutter, T.; De Michelis, C.; Monier-Garbet, P.; Poutchy, L.; Roth,Association Euratom-CEA, Centre d'Etudes de Cadarache, 13 - Saint-Paul-lez-Durance (France). Dept. de Recherches sur la Fusion Controlee. 1992. (CONF-920311–: 10. international conference on plasma-surface interactions in controlled fusion devices, Monterey, CA (United States), 30 Mar - 3 apr 1992). In *Plasma surface interactions in controlled fusion devices.* 141p. Order Number DE93721122. Source: OSTI; NTIS (US Sales Only); INIS.

First boronization was achieved in Tore-Supra with a 10% B_2H_6+He mixture. A quantitative inventory of the boron compound deposition during the boronization by means of residual gas analysis shows that at wall temperature of 200 deg C, 96.4% of the diborane is cracked and this ratio reaches 99.8% when the glow discharge is performed. Analysis of exposed samples yields a high boron concentration and a B/C ratio constant on the 100 nm depth of the deposited layer. The oxygen content of the discharge decreased by a factor of 5, and consequently the M.q product (M being the Murakami parameter) increased from 7 to $11.8.10^{19}m^{-2}T^{-1}$. After the second boronization performed in 10% B_2H_6+D_2 gas mixture a low isotopic ratio H/(H+D) in the plasma and enhanced recycling properties have been obtained.

2375 (EUR-CEA-FC–1456, pp. 81-95) **Effect of impurities on particle collection studies with a modular pump limiter on Tore Supra.** Loarer, T. (Association Euratom-CEA, Centre d'Etudes de Cadarache, 13 - Saint-Paul-lez-Durance (France). Dept. de Recherches sur la Fusion Controlee); Chatelier, M.; Uckan, T.; Horton, L.D.; Mioduszewski, P.K. Association Euratom-CEA, Centre d'Etudes de Cadarache, 13 - Saint-Paul-lez-Durance (France). Dept. de Recherches sur la Fusion Controlee. 1992. (CONF-920311–: 10. international conference on plasma-surface interactions in controlled fusion devices, Monterey, CA (United States), 30 Mar - 3 apr 1992). In *Plasma surface interactions in controlled fusion devices.* 141p. Order Number DE93721122. Source: OSTI; NTIS (US Sales Only); INIS.

Particle collection experiments with a modular pump limiter in TORE SUPRA, for ohmic and additional power heating, are reported. The essential feature of these experiments is that the pressure built up in the pump limiter plenum is only driven by the hydrogen influx whereas the total ion influx in the throat is shown to be partly due to impurities. This is consistent with experimental results which show similar evolution of Z_{eff} in the plasma and of the ratio Γ_T/p of the total ion influx Γ_T in the throat to the pressure p in the plenum. Particle collection efficiency, in terms of hydrogen influx Γ_D to the pressure ratio Γ_D/p, is shown to be roughly constant over the density (ohmic) and additional power ranges studied.

2376 (EUR-CEA-FC–1456, pp. 96-108) **Impurity screening in Tore Supra.** De Michelis, C. (Association Euratom-CEA, Centre d'Etudes de Cadarache, 13 - Saint-Paul-lez-Durance (France). Dept. de Recherches sur la Fusion Controlee); Ghendrih, P.; Grisolia, C.; Grosman, A.; Hess, W.; Mattioli, M.; Monier-Garbet, P. Association Euratom-CEA, Centre d'Etudes de Cadarache, 13 - Saint-Paul-lez-Durance (France). Dept. de Recherches sur la Fusion Controlee. 1992. (CONF-920311–: 10. international conference on plasma-surface interactions in controlled fusion devices, Monterey, CA (United States), 30 Mar - 3 apr 1992). In *Plasma surface interactions in controlled fusion devices.* 141p. Order Number DE93721122. Source: OSTI; NTIS (US Sales Only); INIS.

Ergodic divertor (ED) experiments in helium plasmas with carbonized and boronized wall conditions have been performed in Tore Supra. The intrinsic impurity decontamination effect (as well as the screening of purposely injected nitrogen impurities), previously observed in deuterium plasmas, has been confirmed also for conditions where the electron density in the confined (unperturbed) bulk plasma remains practically constant. Inward displacements of the plasma 0.10 - 0.15 m away from the ED modules result in the magnetic perturbation having little or no effect on impurities.

2377 (EUR-CEA-FC–1456, pp. 109-124) **Actively cooled pump limiters and power scrape-off length measurements in Tore-Supra.** Guilhem, D. (Association Euratom-CEA, Centre d'Etudes de Cadarache, 13 - Saint-Paul-lez-Durance (France). Dept. de Recherches sur la Fusion Controlee); Seigneur, A.; Chappuis, P.; Chatelier, M.; DeMichelis, C.; Deschamps, P.; Grosman, A.; Hess, W.; LecoustAssociation Euratom-CEA, Centre d'Etudes de Cadarache, 13 - Saint-Paul-lez-Durance (France). Dept. de Recherches sur la Fusion Controlee. 1992. (CONF-920311–: 10. international conference on plasma-surface interactions in controlled fusion devices, Monterey, CA (United States), 30 Mar - 3 apr 1992). In *Plasma surface interactions in controlled fusion devices.* 141p. Order Number DE93721122. Source: OSTI; NTIS (US Sales Only); INIS.

TORE-SUPRA is a superconducting Tokamak aimed at studying long plasma pulses (>30 s). It is equipped with two types of pump limiters (PL). A provisional type, semi-inertially cooled between shots, has been used for plasma scrape off characterization. The e-folding length λq for power deposition on these components has been unfolded ($1.0cm < \lambda q < 2.4cm$) for different plasma parameters. On one hand it has been found almost independent of electron density ($10^{19}m^{-3} < ne < 5\ 10^{19}m^{-3}$), of power level up to 4 MW and of toroidal magnetic field ($1.5\ T < Bt < 4\ T$). On the other hand the strongest dependence is with plasma current ($Ip^{-1/2}$). The second type used for long pulse operation, is actively cooled during shots, its thermal time constant being less than 2 seconds. Experiments using this ITER relevant technology are presented. Three of the actively cooled limiters have been successfully tested in a steady state regime with a surface temperature less than 1000 deg C (I_p=1.6 MA). The design value for power removal on this type of limiters has been obtained. Peak power fluxes of 10 MW/m^2 have been estimated. This represents a breakthrough for high heat flux components since critical heat flux and burnout with subcooled flow boiling are major aspects for this kind of design.

2378 (EUR-CEA-FC–1456, pp. 125-141) **Effects of ionizing scrape-off layers on local recycling in Tore Supra pump limiter experiments.** Chatelier, M. (Association Euratom-CEA, Centre d'Etudes de Cadarache, 13 - Saint-Paul-lez-Durance (France). Dept. de Recherches sur la Fusion Controlee); Loarer, T.; Owen, L.W.; Hogan, J.T.; Klepper, C.C.; Mioduszewski, P.K.; Uckan, T. Association Euratom-CEA, Centre d'Etudes de Cadarache, 13 - Saint-Paul-lez-Durance (France). Dept. de Recherches sur la Fusion Controlee. 1992. Contract DE-AC05-84OR21400. (CONF-920311–: 10. international conference on plasma-surface interactions in controlled fusion devices, Monterey, CA (United States), 30 Mar - 3 apr 1992). In *Plasma surface interactions in controlled fusion devices.* 141p. Order Number DE93721122. Source: OSTI; NTIS (US Sales Only); INIS.

A series of ohmic discharges with active pumping in the Tore Supra outboard pump limiter has been analyzed with the DEGAS neutrals transport code and an analytic scrape-off layer (SOL) plasma model. Pumping speed and plenum pressure measurements indicated 5-10 torr.L/s throughput with only modest effects on density. A model is developed in which large exhaust fluxes, with little attendant effect on core plasma density, are explained in terms of SOL ionization of recycled and wall-desorbed neutrals. Particle balance with active pumping and constant line density requires that the wall return flux exceed the incident flux by approximately the pump throughput in the absence of external fueling. The radial profile of the H^+ source rate from ionization and dissociation of wall-desorbed molecules is seen to peak very near the radial position of the limiter throat. Consequently, a strong recycling vortex is created in the region of the limiter, with the ion flux amplified by factors of 2 at the outer limiter surfaces and > 3 within the limiter throat. The calculations indicate that less than 30% of the pump throughput is due to first-generation ions from the core efflux, with the balance from local recycling in the strongly ionizing SOL.

2379 (FRCEA-TH–372) **Radiation control and study of a Tokamak plasma. Use of an ergodic divertor.** Poutchy, L. Association Euratom-CEA, Centre d'Etudes de Cadarache, 13 - Saint-Paul-lez-Durance (France). Dept. de Recherches sur la Fusion Controlee; Aix-Marseille-1 Univ., 13 - Marseille (France). 15 Sep 1992. 169p. (In French). Order Number DE93721708. Source: OSTI; NTIS (US Sales Only); INIS.

The major problem of controlled thermonuclear fusion is the interaction between the plasma and the wall. It should be interesting to dissipate the power contained in the plasma through a peripheral radiating layer. This solution should allow the homogenization of the power deposition on the wall. The plasma confinement requires the localization of the radiation at the plasma edge. That is the reason why the impurities contained in the plasma have to be light impurities like carbon or oxygen, which radiate for low temperature (10 eV to 100 eV). The different mechanisms of radiation are recalled and the bolometers used on Tore Supra for radiation measurements are recalled. When the plasma density reaches a critical value dependent on the impurity content of the plasma, the radiating rate increases and edge radiating phenomena as 'marfes' and 'detached plasma' are observed. This phenomena are unstable and lead to a radiating cooling of the plasma. This cooling causes the growth of tearing instabilities and the disruption. The objectives of this work were to settle a method for avoiding disruptions and for maintaining a radiating layer at the plasma edge. Thus, radiating losses and MHD instabilities are studied. The Ergodic Divertor acts on the magnetic structure of the plasma edge and stabilizes the MHD activity. This property has been used to define a discharge piloting strategy to prevent density-limit disruptions. This strategy allows also (if the plasma edge contamination is sufficient) the stabilization of an edge radiating layer which dissipates 100% of the input power.

2380 (GA-A–21034) **Enhancement of DIII-D neutral beam system for higher performance.** Hong, R.; Colleraine, A.P.; Kellman, D.H.; Kim, J.; Luxon, J.L.; Nerem, A.; Phillips, J.; Wight, J. General Atomics, San Diego, CA (United States). Sep 1992. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-89ER51114. (CONF-920930–6: 17. symposium on fusion technology, Rome (Italy), 14-18 Sep 1992). Order Number DE93000878. Source: OSTI; NTIS; INIS; GPO Dep.

The DIII-D tokamak employs eight neutral beam systems for plasma heating and current drive experiments. These positive ion source neutral beam systems have gone through several improvements in operational technique and in system hardware since the start of conditioning of the first long pulse ion source in December 1986. These improvements have led to the routine operation in deuterium at beam power levels of 20 MW. The improvements in operational technique include filament power supply operating mode, accelerator grid voltage holding capability, mid changes in grid potential gradients. The hardware improvements include installation of arc notching, arc discharge density regulation, and control of neutralizer gas puffing. Each of these improvements are discussed in this paper. Successful testing and operation of the ion source at 93 kV deuterium beam energy, well above the design value of 80 kV, also led to the possibility of enhancing system capability to 28 MW power level, nearly twice the original design value. Upgrading of the beam system to 60 second pulse duration at the currently achieved power level is under consideration. Studies have shown that this pulse length extension can be achieved with improvements in beamline heat handling components and auxiliary systems, especially the power supply system. The drift duct (the section between neutral beam beamline and tokamak) upgrade and protection for the long pulse duration present the greatest challenges, and are crucial to achieving long pulse beam injection into the tokamak plasma.

2381 (GA-A–21035) **Analytical prediction of thermal performance of hypervapotron and its application to ITER.** Baxi, C.B. (General Atomics, San Diego, CA (United States)); Falter, H. General Atomics, San Diego, CA (United States). Sep 1992. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-89ER51114. (CONF-920930–8: 17. symposium on fusion technology, Rome (Italy), 14-18 Sep 1992). Order Number DE93001356. Source: OSTI; NTIS; INIS; GPO Dep.

A hypervapotron (HV) is a water cooled device made of high thermal conductivity material such as copper. A surface heat flux of up to 30 MW/m^2 has been achieved in copper hypervapotrans cooled by water at a velocity of 10 m/s and at a pressure of six bar. Hypervapotrons have been used in the past as beam dumps at the Joint European Torus (JET). It is planned to use them for diverter cooling during Mark II upgrade of the JET. Although a large amount of experimental data has been collected on these devices, an analytical performance prediction has not been done before due to the complexity of the heat transfer mechanisms. A method to analytically predict the thermal performance of the hypervapotron is described. The method uses a combination of a number of thermal hydraulic correlations and a finite element analysis. The analytical prediction shows an excellent agreement with experimental results over a wide range of velocities, pressures, subcooling, and geometries. The method was used to predict the performance of hypervapotron made of beryllium. Merits for the use of hypervapotrons for International Thermonuclear Experimental Reactor (ITER) and Tokamak Physics Experiment (TPX) are discussed.

2382 (IYaF–90-141) **Magnetic system of the GOL-3 plasma device.** Deulin, Yu.I.; Lebedev, S.V.; Nikolaev, V.S.; Semenov, E.P. AN SSSR, Novosibirsk (Russian Federation). Inst. Yadernoj Fiziki. 1991. 9p. (In Russian). Order Number DE93606291. Source: OSTI; NTIS (US Sales Only); INIS.

Magnetic system of the GOL-3 device where the experiments on plasma heating by an intense relativistic electron beam beam are conducted, is described. The magnetic field in the solenoid makes up 6T, in magnetic mirrors on the solenoid end points -12T.

2383 (IYaF–91-105) **Vacuum-plasma system of the GOL-3 device.** Burdakov, A.V.; Dranichnikov, A.N.; Kojdan, V.S.; Nikolaev, V.S.; Postupaev, V.V.; Tauber, M.V. AN SSSR, Novosibirsk (Russian Federation). Inst. Yadernoj Fiziki. 1991. 20p. (In Russian). Order Number DE93606292. Source: OSTI; NTIS (US Sales Only); INIS.

Vacuum system of the GOL-3 device, comprising a vacuum chamber, intrachamber diagnostics and vacuum pumping system, is developed, manufactured and put into operation. The system is flexible, capatable of simple reservation of the most important systems and is easy to operate. The design parameters are achieved including the limiting and operating vacuum, operating hydrogen pressure, the device readiness time. The system of producing the preliminary plasma design a heavy-current direct discharge in a metal chamber in an intense magnetic chamber in an intense magnetic field is developed. The technical solutions installed allow one to use this system in experiments on plasma heating by heavy-current relativistic electron beam. 8 refs.; 6 figs.

2384 (LA-UR–92-2904) **A need for non-tokamak approaches to magnetic fusion energy.** Bathke, C.G.; Krakowski, R.A.; Miller, R.L. Los Alamos National Lab., NM (United States). [1992]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE93000794. Source: OSTI; NTIS; INIS; GPO Dep.

Focusing exclusively on conventional tokamak physics in the quest for commercial fusion power is premature, and the options for both advanced-tokamak and non-tokamak concepts need continued investigation. The basis for this claim is developed, and promising advanced-tokamak and non-tokamak options are suggested.

2385 (LA-UR–92-2993) **A systems analysis of the ARIES tokamak reactors.** Bathke, C.G. Los Alamos National Lab., NM (United States). [1992]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-920930–3: 17. symposium on fusion technology, Rome (Italy), 14-18 Sep 1992). Order Number DE93000686. Source: OSTI; NTIS; INIS; GPO Dep.

The multi-institutional ARIES study has completed a series of cost-of-electricity optimized conceptual designs of commercial tokamak fusion reactors that vary the assumed advances in technology and physics. A comparison of these designs indicates the cost benefit of various design options. A parametric systems analysis suggests a possible means to obtain a marginally competitive fusion reactor.

2386 (LA-UR–92-3161) **Preparation of microcellular foam in cylindrical metal targets.** Apen, P.G.; Armstrong, S.V.; Moore, J.E.; Espinoza, B.F.; Gurule, V.; Gobby, P.L.; Williams, J.M. Los Alamos National Lab., NM (United States). 1 Oct 1992. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-921129–1: 39. national symposium of the American Vacuum Society, Chicago, IL (United States), 9-13 Nov 1992). Order Number DE93000699. Source: OSTI; NTIS; INIS; GPO Dep.

The preparation of microcellular foam in cylindrical gold targets is described. The goal cylinders were fabricated by electroplating gold onto a silicon bronze mandrel and leaching the mandrel with concentrated nitric acid. After several rinsing and cleaning steps, the cylinders were filled with a solution containing trimethylolpropanetriacrylate (TMPTA). Low density, microcellular polymeric foam was prepared by in situ photopolymerization of the TMPTA solution. Foam preparation was extremely sensitive to metal ion contaminants. In particular, copper ions left behind from the leaching process inhibit polymerization and must be removed in order to obtain uniform, non-shrinking foams. A study on the effects of potential contaminants and polymerization inhibitors on TMPTA photopolymerization is presented. In addition, a procedure for the effective leaching and cleaning of gold cylinders is described.

2387 (LA-UR–92-3164) **Mercury: A second-generation KrF laser for inertial fusion research.** Bigio, I.J.; York, G.; McLeod, J.; Czuchlewski, J.; Rose, E.; Hanson, D.E.; Kurnit, N.A.; McCown, A. Los Alamos National Lab., NM (United States). [1992]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-920959–1: 9. international symposium on gas flow and chemical lasers, Heraklion (Greece), 21-25 Sep 1992). Order Number DE93000698. Source: OSTI; NTIS; INIS; GPO Dep.

The "Mercury" KrF laser facility at Los Alamos is being built with the benefit of lessons learned from the Aurora KrF laser. An increased understanding of KrF laser engineering, and the designed implementation of system flexibility, will permit Mercury to serve as a testbed for a variety of advanced KrF technology concepts.

2388 (LBL–30340) **The development of compact magnetic quadrupoles for ILSE.** Faltens, A.; Mukherjee, S.; Brady, V. Lawrence Berkeley Lab., CA (United States). Aug 1990. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-901219–17: International symposium on heavy ion inertial fusion, Monterey, CA (United States), 3-6 Dec 1990). Order Number DE92041189. Source: OSTI; NTIS; INIS; GPO Dep.

Magnetic focussing is selected for the 4 MeV to 10 MeV section of the Induction Linac Systems Experiments (ILSE) to study the transport of magnetically focussed spacecharge-dominated beams and to explore the engineering problems in accurate positioning of the magnetic fields in an array of quadrupoles. A prototype development program for such magnets is currently under way. A compact design was selected to decrease the overall accelerator diameter and its cost. The design evolved from a cosine 2θ current distribution, corrected for end effects. Current-dominated magnets are used in a pulsed mode to allow higher current densities compared to standard dc water-cooled conductors. The POISSON and MAFCO codes were used in the design of the magnets. The construction of the quadrupoles is aimed at achieving location accuracy of the magnetic center to within 1 mil (2.54×10^{-5} m) of the mechanical center.

2389 (LBL–32038) **Ion sources for cyclotron applications.** Leung, K.N.; Bachman, D.A.; McDonald, D.S.; Young, A.T. Lawrence Berkeley Lab., CA (United States). Jul 1992. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-920741–4: 13 international conference on cyclotrons and their applications, Vancouver (Canada), 6-16 Jul 1992). Order Number DE93000568. Source: OSTI; NTIS; INIS; GPO Dep.

The use of a multicusp plasma generator as an ion source has many advantages. The development of both positive and negative ion beams based on the multicusp source geometry is presented. It is shown that these sources can be operated at steady state or cw mode. As a result they are very suitable for cyclotron operations.

2390 (NRL/MR–4790-92-7112) **Current neutralization in ballistic transport of light ion beams.** Hubbard, R.F.; Slinker, S.P.; Lampe, M.; Joyce, G.; Ottinger, P. Naval Research Lab., Washington, DC (United States). 6 Oct 1992. 45p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93000881. Source: OSTI; NTIS; INIS; GPO Dep.

Intense light ion beams are being considered as drivers to ignite fusion targets in the Laboratory Microfusion Facility (LMF). Ballistic transport of these beams from the diode to the target is possible only if the beam current is almost completely neutralized by plasma currents. This paper summarizes related work on relativistic electron beam and heavy ion beam propagation and describes a simple simulation model (DYNAPROP) which has been modified to treat light ion beam propagation. DYNAPROP uses an envelope equation to treat beam dynamics and uses rate equations to describe plasma and conductivity generation. The model has been applied both to the high current, 30 MeV Li^{+3} beams for LMF as well as low current, 1.2 MeV proton beams which are currently being studied on GAMBLE B at the Naval Research Laboratory. The predicted ratio of net currents to beam current is ~0.1–0.2 for the GAMBLE experiment and ~0.01 for LMF. The implications of these results for LMF and the GAMBLE experiments art discussed in some detail. The simple resistive model in DYNAPROP has well-known limitations in the 1 torr regime which arise primarily from the neglect of plasma electron transport. Alternative methods for treating the plasma response are discussed.

2391 (UCLA-PPG–1323-Vol.2) **The ARIES-I tokamak reactor study: Volume 2, final report.** California Univ., Los Angeles, CA (United States). Inst. of Plasma and Fusion Research. 1991. 639p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG03-86ER52126 ;W-31109-ENG-38 ;AC03-89ER52153 ;AC07-76ID01570 ;W-7405-ENG-36 ;FG02-91ER54110 ;AC02-76CH03073 ;FG0 Order Number DE93002185. Source: OSTI; NTIS; INIS; GPO Dep.

This report contains an overview of the Aries-I tokamak reactor study. The following topics are discussed on this tokamak: Systems studies; equilibrium, stability, and transport; summary and conclusions; current drive; impurity control system; tritium systems; magnet engineering; fusion-power-core engineering; power conversion; Aries-I safety design and analysis; design layout and maintenance; and start-up and operations.

2392 (UCRL-JC–110021) **Calculations of dynamic stresses in the envelopes of pulsed Xe flashlamps.** Holdener, F.R.; Platt, E.A.; Erlandson, A.C.; Frank, D.N.; Gelinas, R.J.; Jancaitis, K.S.; Larson, D.W.; Sinz, K.H. Lawrence Livermore National Lab., CA (United States). 31 Aug 1992. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-920768–6: Conference on physics and engineering of advanced detectors and collection/focusing systems, San Diego, CA (United States), 19-24 Jul 1992). Order Number DE93000632. Source: OSTI; NTIS; GPO Dep.

We have modeled dynamic stresses in the envelopes of pulsed xenon flashlamps, treating stresses produced by three different sources: the heating of the envelope by the plasma; the pressure rise of the xenon gas; and magnetic forces, due to currents flowing in nearby lamps. The heat-induced stresses were calculated by the finite element method, using uniform heating rates for the inside surface of the envelope that were inferred from flashlamp radiant efficiency measurements. Pressure-induced stresses were calculated analytically, using empirical relationships for temperature and pressure in terms of current density. Magnetically-induced stresses were also calculated analytically, for flashlamps packed parallel to each other in linear arrays.

2393 (UW-CPTC–92-4) **Calculation of neutral beam deposition accounting for excited states.** Gianakon, T.A. Wisconsin Univ., Madison, WI (United States). Dept. of Nuclear Engineering and Engineering Physics. Sep 1992. 44p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-86ER53218. Order Number DE93002353. Source: OSTI; NTIS; INIS; GPO Dep.

Large-scale neutral-beam auxillary heating of plasmas has led to new plasma operational regimes which are often dominated by fast ions injected via the absorption of an energetic beam of hydrogen

neutrals. An accurate simulation of the slowing down and transport of these fast ions requires an intimate knowledge of the hydrogenic neutral deposition on each flux surface of the plasma. As a refinement to the present generation of transport codes, which base their beam deposition on ground-state reaction rates, a new set of routines, based on the excited states of hydrogen, is presented as mechanism for computing the attenuation and deposition of a beam of energetic neutrals. Additionally, the numerical formulations for the underlying atomic physics for hydrogen impacting on the constiuent plasma species is developed and compiled as a numerical database. Sample results based on this excited state model are compared with the ground-state model for simple plasma configurations.

99 GENERAL AND MISCELLANEOUS

Refer also to citation(s) 743, 746

2394 (GB–461) **Annual report 1991.** World Energy Council, London (UK). 1992 52p. Order Number DE93727502. Source: OSTI; NTIS (US Sales Only).

This annual report gives details of the World Energy Executive's appointments, representation at International Organisations, membership of committees, future meetings and energy forums, and study committees. The financial report and accounts for the year ending December 1991 are presented. (UK).

2395 (HW–53961) **Hanford Laboratories operation monthly activities report, November 1957.** General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 15 Dec 1957. 161p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93000766. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This is the monthly report for the Hanford Laboratories Operation. Metallurgy, reactor fuels, physics and instrumentation, reactor technology, chemistry, separation processes, biology, financial activities, employee relations, laboratories auxiliaries, radiation protection, operation research, inventions, visits, and personnel status are discussed. This report is for November 1957.

2396 (HW–55162-Del.) **Hanford Laboratories operation monthly activities report, February 1958.** General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 15 Mar 1958. 161p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93000768. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This is the monthly report for the Hanford Laboratories Operation. Metallurgy, reactor fuels, physics and instrumentation, reactor technology, chemistry, separation processes, biology, financial activities, employee relations, laboratories auxiliaries, radiation protection, operation research, inventions, visits, and personnel status are discussed. This report is for February 1958.

2397 (HW–65459) **Hanford Laboratories operation monthly activities report, May 1960.** General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 15 Jun 1960. 173p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93001333. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This is the monthly report for the Hanford Laboratories Operation. Metallurgy, reactor fuels, physics and instrumentation, reactor technology, chemistry, separation processes, biology, financial activities, employee relations, laboratories auxiliaries, radiation protection, operation research, inventions, visits, and personnel status are discussed. This report is for May 1960.

2398 (KFK–5031) **Progress report on research and development work 1991 of the Department of Hot Chemistry, Karlsruhe Nuclear Research Center.** Kernforschungszentrum Karlsruhe GmbH (Germany). Inst. fuer Heisse Chemie. Mar 1991. 27p. (In German). Order Number DE93720183. Source: OSTI; NTIS (US Sales Only); INIS.

In the year under review, the Institute of Hot Chemistry (IHCH) was in the midst of a thematic reorientation process. The priority of future chemical-technical work will be in the field of the development of supercriticality processes. The objective of such work consists in seeking new ways for getting rid of resistant chemical pollutants (halogenated organic compounds). The following projects are presented in detail: (1) Waste control in the environment (communal waste management; water and soil; emission-reducing processes; highly polluted soils); (2) Solid state and materials research (chemistry of materials research); basic physical research (neutrino and particle physics); (3) Nuclear waste management (concluding work on reprocessing technology), and (4) Other research projects (Institute-related research). The Annex lists the publications made by the IHCH staff. (BBR).

2399 (KFK–5047) **Progress report on research and development work 1991 of the Department for Applied Systems Analysis, Karlsruhe Nuclear Research Center.** Kernforschungszentrum Karlsruhe GmbH (Germany). Abt. fuer Angewandte Systemanalyse. Mar 1991. 17p. (In German). Order Number DE93720174. Source: OSTI; NTIS (US Sales Only); INIS.

The following technology-oriented studies were conducted in the time period of the report: Technology assesment regarding 'Renewable Resources'; Environmental and health impact of the manufacturing and application and waste management of components and integrated circuits of micro- and optoelectronics; studies on product-oriented reduction of pollution, an innovative electronic form of presenting results of scientific projects: developing an electronic book prototype; expert systems and application of knowledge. (orig.).

9901 Management

Refer also to citation(s) 247, 640, 642, 643, 644, 645, 647, 648, 649, 652, 744, 745, 746, 747, 748, 797, 800

2400 (AECL–9108) **Progress report - chemistry and materials division 1985 July 01 - December 31.** Atomic Energy of Canada Ltd., Chalk River, ON (Canada). Chalk River Nuclear Labs. Feb 1986. 109p. (PR-CMa–69.). Order Number DE93604073. Source: OSTI; NTIS (US Sales Only); INIS.

Progress is reported in Chalk River's research programs in solid state science, general chemistry, physical chemistry, and materials science.

2401 (AECL–10180/A) **Atomic Energy of Canada Limited annual report 1989-1990.** Atomic Energy of Canada Ltd., Ottawa, ON (Canada). 1990. 62p. (In English, French). Order Number DE93604072. Source: OSTI; NTIS (US Sales Only); INIS.

In 1990, after a comprehensive industry review, the Canadian government announced that steps would be taken to revitalize the nuclear industry. Canada's nuclear utilities made a commitment to bear a large share of the cost of nuclear research and development. Atomic Energy of Canada Limited (AECL) reported its first financial loss in twelve years, as anticipated at the start of the year. Four of the 20 CANDU reactors operating worldwide were in the top ten based on lifetime performance. By year-end one foreign and two domestic utilities had announced their intention to build more CANDU units. The federal government has agreed to stabilize AECL's research funding at 1989-90 levels ($31.5 million above levels planned in 1985), has authorized AECL to negotiate with New Brunswick to build Point Lepreau-2 as the prototype for the CANDU-3 reactor, and has allowed the restructuring of AECL so utility and private sector investors can become equity partners in AECL CANDU.

2402 (EDF-DER-RA–1991-2) **D.E.R. 91 main facts.** Electricite de France (EDF), 75 - Paris (France). 1991. 141p. (In French). Order Number DE93721226. Source: OSTI; NTIS (US Sales Only); INIS.

This report presents the main facts of the studies carried out by the Direction des Etudes et Recherches (DER) of Electricite de France: New applications of electricity, classical and nuclear thermal power plants, electrical equipment, environment protection, network analysis, information and informatic equipment.

2403 (EUR–13647/III) **Summary reports of the R and D programme: primary raw materials (1986-89) - Volume III.** Donato, M. (Commission of the European Communities, Brussels (Belgium)). Commission of the European Communities, Luxembourg (Luxembourg). 1992. 1046p. Source: OSTI; NTIS (US Sales Only); INIS.

Separate abstracts were prepared for 3 of the papers in this volume. The remaining 22 papers were considered out of the INIS scope.

2404 (IAEA-INFCIRC–1(Rev.10)) **Information circulars.** International Atomic Energy Agency, Vienna (Austria). Aug 1992. 124p. Order Number DE93604074. Source: OSTI; NTIS (US Sales Only); INIS.

The document summarizes the Information Circulars published by the IAEA for the purpose of bringing matters of general interest to the attention of all Members of the Agency. This revision contains INFCIRCs published up to mid-August 1992. A complete numerical lift of Information Circulars with their titles is reproduced in an Annex.

2405 (INIS-BR–2942) **Triennial technical report - 1986, 1987, 1988 - Instituto de Engenharia Nuclear (IEN) -Dept. of Reactors (DERE).** Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1989 147p. (In Portuguese). Order Number DE93605069. Source: OSTI; NTIS (US Sales Only); INIS.

The research activities developed during the period 1986, 1987 and 1988 by the Reactor Department of Brazilian Nuclear Energy Commission (CNEN-DERE) are summarized. The principal aim of the Department of Reactors is concerned to the study and development of fast reactors and research thermal reactors. The DERE also assists the CNEN in the areas related to analysis of power reactor structure; to teach Reactor Physics and Engineering at the University, and professional training to the Nuclear Engineering Institute. To develop its research activity the DERE has three big facilities: Argonauta reactor, CTS-1 sodium circuit, and water circuit. (M.I.).

2406 (INIS-mf–13368) **Regulatory inspection of the implementation of quality assurance programmes.** Bezpecnost Jadernych Zarizeni. Ceskoslovenska Komise pro Atomovou Energii, Prague (Czechoslovakia). 1992 108p. Translation of IAEA publication (Technical Report Series No. 296). International Atomic Energy Agency, Vienna 1989. (In Czech). Order Number DE93606018. Source: OSTI; NTIS (US Sales Only); INIS.

This manual provides guidance to Member States in the organization and performance of their regulatory inspection functions regarding the implementation of nuclear power plant quality assurance programmes. It addresses the interface between, and is consistent with, the IAEA Nuclear Safety Standards (NUSS programme) documents on quality assurance and governmental organization. The manual offers a practical model and examples for performing regulatory inspections to ensure that the quality assurance programme is operating satisfactorily in the siting, design, manufacturing, construction, commissioning, operation and decommissioning of nuclear power plants. The primary objective is to confirm that the licensee has the capability to manage and control the effective performance of all quality assurance responsibilities during all phases of a nuclear power project. The guidance provided through this manual for proper establishment and execution of the regulatory inspections helps to enforce the effective implementation of the quality assurance programme as a management control system that the nuclear industry should establish and use in attaining the safety and reliability objectives for nuclear installations. This enforcement action by national regulatory bodies and the emphasis on the purposes and advantages of quality assurance as an important management tool integrated within the total project task have been recommended by the IAEA International Nuclear Safety Advisory Group (INSAG). The primary intended users of this manual are the management personnel and high level staff from regulatory bodies but it will also be helpful to management personnel from nuclear utilities and vendors. They all are inevitable partners in a nuclear power project and this document offers all of them valuable information on the better accomplishment of quality assurance activities to ensure the common objective of safe and reliable nuclear power production.

2407 (KAERI/RR–1075/91) **Studies on establishment of nuclear safety policy.** Koh, Byung Ryung (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Ko, Seong Eun; Park, Yun Pyo; Hong, Eon Yung; Lee, Byoung Oon; Ha, Kwi Seok. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Jan 1992. 121p. (In Korean). Order Number DE93606019. Source: OSTI; NTIS (US Sales Only); INIS.

The purpose of the studies, as a first step in preparing these provisions, is to establish the long-term plan for nuclear safety research and to define the division of responsibilities for related organizations. The results of the work to the end of 1991 are as follows : 1. A Long-Term Plan for Nuclear Safety Research : The research direction and status of nuclear safety of nuclear advanced countries, such as the U.S.A. and Japan, have been analyzed and compared to those of Korea. Based on these results, a long-term nuclear safety research plan, including its implementation, has been suggested for the seven areas : (1.Severe Accident, 2.PSA(Probabilistic Safety Assessment), 3.Thermo-Hydraulic Transients, 4.Inspection and Maintenance for Operating Plant, 5.Seismology, 6.Human Factors, 7.Environments) 2. DOR between Nuclear Safety Research Organizations Nuclear advanced countries, such as the U.S.A., Japan, France and Canada, have their own research programs that are appropriate to their domestic need and environment. In these studies, the research programs and the DOR status for safety research in the above four countries was analyzed and compared to those of Korea. The results were used to define the DOR for related organizations in Korea and to propose the implementation methods for nuclear safety research. (Author).

2408 (KTM/E-C–26) **Nuclear energy research of the European Community: Report on Finnish participation.** Routti, J.; Immonen, S. Technical Research Centre of Finland, Espoo (Finland). Jan 1991. 71p. (In Finnish). Order Number DE93606020. Source: OSTI; NTIS; INIS.

In the report The Advisory Committee on Nuclear Energy examines the possibilities and needs of Finland to participate in the research programmes in the field of nuclear energy within the Framework Programmes for research and technology of the European Community (EC). In addition to the research aspects, the Advisory Committee also examines the adequacy of the researcher resources and the financial effects of the possible participation in Finland.

2409 (NEI-SE–98) **SA/R and D-reports: Listings for 1980-1991.** Swedish Plant Inspectorate, Stockholm (Sweden). 1992. 10p. (In English, Swedish). Order Number DE93604075. Source: OSTI; NTIS; INIS.

A list of publications. Mainly the reports are dealing with safety tests and controls of pipes and components used in the nuclear industry.

2410 (VTT-EKA-B–8) **Nuclear energy related research: Research Programme Plan 1991.** Mattila, L.; Vanttola, T. (comps.). Technical Research Centre of Finland, Espoo (Finland). Oct 1991. 48p. Order Number DE93606021. Source: OSTI; NTIS; INIS.

The annual Research Programme Plan describes the publicly funded nuclear energy related research to be carried out mainly at the Technical Research Centre of Finland (VTT) in 1991. The research is financed primarily by the Ministry of Trade and Industry (KTM), the Finnish Centre for Radiation and Nuclear Safety (STUK) and VTT itself. Other research institutes, utilities and industry also contribute to many projects.

9902 Mathematics and Computers

Refer also to citation(s) 219, 256, 261, 466, 467, 488, 535, 550, 552, 566, 591, 593, 594, 698, 702, 722, 726, 727, 759, 787, 816, 847, 848, 930, 980, 1007, 1069, 1181, 1214, 1219, 1226, 1235, 1246, 1258, 1315, 1393, 1412, 1461, 1462, 1467, 1468, 1469, 1473, 1487, 1492, 1502, 1537, 1675, 1778, 1829, 2062, 2097, 2190, 2194, 2203, 2393

2411 (AECL–10415) **Mathematical preliminaries to the advanced treatment of Hamiltonian dynamics.** Douglas, S.R. Atomic Energy of Canada Ltd., Chalk River, ON (Canada). Chalk River Nuclear Labs. Jul 1991. 33p. Order Number DE93604062. Source: OSTI; NTIS (US Sales Only); INIS.

Hamilton's equations of motion and their solution are discussed from the viewpoints of geometry and algebra. The intention is to explain the mathematical underpinnings of the Lie algebraic methods due to A. Dragt and co-workers for solving problems in charged particle optics. Most of the important formulas in Lie algebraic optics are derived. These methods are being applied to the study of the particle trajectories in the superconducting cyclotron at Chalk River Laboratories.

2412 (AECL–10423) **The multigrid method for reactor calculations.** Douglas, S.R. Atomic Energy of Canada Ltd., Chalk River, ON (Canada). Chalk River Nuclear Labs. Jul 1991. 24p. Order Number DE93604063. Source: OSTI; NTIS (US Sales Only); INIS.

Iterative solutions to linear systems of equations are discussed. The emphasis is on the concepts that affect convergence rates of these solution methods. The multigrid method is described, including the smoothing property, restriction, and prolongation. A simple example is used to illustrate the ideas.

2413 (ANL/CP–75674) **The design of the AIE: An object-oriented application development system.** Fuja, R.S.; Widing, M.A. Argonne National Lab., IL (United States). 27 Feb 1992. 20p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-921084–2: Conference on object-oriented programming systems, languages, and applications, Vancouver (Canada), 18-22 Oct 1992). Order Number DE92041098. Source: OSTI; NTIS; GPO Dep.

Three years ago, in response to our challenging development context, the Advanced Modeling and Analysis Section designed and implemented an object-oriented environment -- the Application Interface Engine (AIE). Our prototyping requirements forced existing application development systems beyond their capabilities. Programmers at AMAS and its contractors have developed over twenty applications using AIE. Our initial experience has been very positive. AIE extends an object-oriented programming language with syntax and classes to support applications specification. This extended system improves all stages of the application engineering life cycle, from rapid prototyping to long term maintenance.

2414 (ANL/CP–76898) **ADIFOR: A Fortran system for portable automatic differentiation.** Bischof, C.; Griewank, A. Argonne National Lab., IL (United States). [1992]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9209215–1: 4. AIAA USAF/NASA/OAI symposium on multidisciplinary analysis and optimization, Cleveland, OH (United States), 21-23 Sep 1992). Order Number DE92040743. Source: OSTI; NTIS; GPO Dep.

Automatic differentiation provides the foundation for sensitivity analysis and subsequent design optimization of complex systems by reliably computing derivatives of large computer codes, with the potential of doing it many times faster compared to current approaches. This paper describes the ADIFOR (Automatic DIfferentiation of FORtran) system, a translator that augments Fortran programs with statements for the computation of derivatives. ADIFOR accepts arbitrary Fortran 77 code defining the computation of a function and writes portable Fortran 77 code for the computation of its derivatives. Our goal is to free the computational scientist from worrying about the accurate and efficient computation of derivatives, even for complicated "functions," thereby enabling him to concentrate on the more important issues of system modeling and algorithm design. This paper gives an overview of the principles underlying the ADIFOR system, and comments on the power of automatic differentiation for computing derivatives of implicitly-defined functions.

2415 (ANL/CP–77114) **Domain decomposition as a mechanism for using asymptotic methods.** Gropp, W.D. (Argonne National Lab., IL (United States)); Keyes, D.E. Argonne National Lab., IL (United States). [1992]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9205253–1: NATO workshop on numerical methods for partial differential equations and critical parameters, Beaune (France), 25-28 May 1992). Order Number DE92040759. Source: OSTI; NTIS; GPO Dep.

This paper summarizes some recent advances in numerical analysis for PDEs, particularly those in algebraic domain decomposition techniques, and demonstrates how such methods may be combined with asymptotic methods to provide robust and effective solvers.

2416 (ANL/MCS-TM–168) **ADIFOR case study: VODE + ADIFOR: ADIFOR working note No. 10.** Corliss, G. Argonne National Lab., IL (United States). Aug 1992. 10p. Sponsored by USDOE, Washington, DC (United States); National Science Foundation, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE93000894. Source: OSTI; NTIS; GPO Dep.

ADIFOR can be used to generate the Jacobians required by VODE in a manner that is easy to use. We provide a template to interface the ADIFOR-generated code with VODE and show how the template is used in a sample system of stiff ordinary differential equation. The ADIFOR-generated code is about 10% faster than the hand-coded Jacobian for this example.

2417 (BARC–1991/E/023) **A static analysis tool set for assembler code verification.** Dhodapkar, S.D. (Bhabha Atomic Research Centre, Bombay (India). Reactor Control Div.); Bhattacharjee, A.K.; Sen, Gopa. Bhabha Atomic Research Centre, Bombay (India). 1991. 46p. Order Number DE93606012. Source: OSTI; NTIS (US Sales Only); INIS.

Software Verification and Validation (V and V) is an important step in assuring reliability and quality of the software. The verification of program source code forms an important part of the overall V and V activity. The static analysis tools described here are useful in verification of assembler code. The tool set consists of static analysers for Intel 8086 and Motorola 68000 assembly language programs. The analysers examine the program source code and generate information about control flow within the program modules, unreachable code, well-formation of modules, call dependency between modules etc. The analysis of loops detects unstructured loops and syntactically infinite loops. Software metrics relating to size and structural complexity are also computed. This report describes the salient features of the design, implementation and the user interface of the tool set. The outputs generated by the analyser are explained using examples taken from some projects analysed by this tool set. (author). 7 refs., 17 figs.

2418 (BNL–47892) **Uniform convergence estimates for multigrid V-cycle algorithms with less than full elliptic regularity.** Bramble, J.H.; Pasciak, J.E. Brookhaven National Lab., Upton, NY (United States). Mar 1992. 10p. Sponsored by USDOE, Washington, DC (United States); Department of Defense, Washington, DC (United States); National Science Foundation, Washington, DC (United States). DOE Contract AC02-76CH00016. Grant DMS84-05352;Grant DMS88-05311-04. (CONF-9206290–1: 6. international conference on domain decomposition methods in science and engineering, Como (Italy), 14-21 Jun 1992). Order Number DE92041275. Source: OSTI; NTIS; GPO Dep.

In this paper, we provide uniform estimates for V-cycle algorithms with one smoothing on each level. This theory is based on some elliptic regularity but does not require a smoother interaction hypothesis (sometimes referred to as a strengthened Cauchy Schwarz inequality) assumed in other theories. Thus, it is a natural extension of the full regularity V-cycle estimates provided by Braess and Hackbush.

2419 (CONF-9208159–1) **Hermite interpolation algorithm for 2D fracture mechanics.** Potyondy, D.O. (Cornell Univ., Ithaca, NY (United States)); Ingraffea, A.R.; Gray, L.J. Oak Ridge National Lab., TN (United States). 26 Mar 1992. 4p. Sponsored by USDOE, Washington, DC (United States); National Science Foundation, Washington, DC (United States). DOE Contract AC05-84OR21400. From IABEM-2: International Association for Boundary Elements (IABE) meeting; Boulder, CO (United States); 2-5 Aug 1992. Order Number DE92041266. Source: OSTI; NTIS; GPO Dep.

Extended abstract.

Short communication. FRACTURE MECHANICS/interpolation; ALGORITHMS; INTERPOLATION; HERMITE POLYNOMIALS; CRACK PROPAGATION; TWO-DIMENSIONAL CALCULATIONS

2420 (DOE/MC/24207–2995) **Development of algorithms for capacitance imaging techniques for fluidized bed flow fields: 1990 Annual report.** Loudin, W.J. West Virginia Univ., Morgantown, WV (United States). Dept. of Mathematics. Jan 1991. 36p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC21-87MC24207. Order Number DE91002076. Source: OSTI; NTIS; GPO Dep.

The objective of this research is to provide support for the instrumentation concept of a High Resolution Capacitance Imaging System (HRCIS). The work involves the development and evaluation of the mathematical theory and associated models and algorithms which reduce the electronic measurements to valid physical characterizations. The research and development require the investigation of techniques to solve large systems of equations based on capacitance measurements for various electrode configurations in order to estimate densities of materials in a cross-section of a fluidized bed. Capacitance measurements are made for 400 connections of the 32-electrode system; 400 corresponding electric-field curves are constructed by solving a second order partial differential equation. These curves are used to partition the circular disk into 193 regions called pixels, and the density of material in each pixel is to be estimated. Two methods of approximating densities have been developed and consideration of a third method has been initiated. One method (Method 1) is based on products of displacement currents for intersecting electric-field curves on a cross section. For each pixel one point of intersection is chosen, and the product of the capacitance measurements is found. Both the product and the square-root-of-product seem to yield good relative distribution of densities.

2421 (ESTSC–000434IBMPC00) **AMFU: Alternative motor fuel use model.** Green, D. (Oak Ridge National Lab, TN (United States)); Rathi, A. Oak Ridge National Lab., TN (United States). 1 Mar 1990. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Source: ESTSC.

Description: IBM PC; MS-DOS Version 2.1 or higher; Compiled BASIC.

AMFU is a tool for the analysis and prediction of motor fuel use by highway vehicles. The model advances the art of vehicle stock modeling by including a representation of the choice of motor fuel for flexible and dual fuel vehicles.

2422 (ESTSC–000440CY00000) **FEFF 5.03: Ab initio X-ray Absorption Fine Structure Code.** Zabinsky, S.I. (University of Washington, Seattle, WA (United States)); Rehr, J.J.; Albers, R.C. Washington Univ., Seattle, WA (United States). 27 Apr 1992. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG06-90ER45415. Source: ESTSC.

Description: CRAY; Designed to be portable; FORTRAN 77; One 3.5 diskette.

FEFF5.03 calculates single and multiple-scattering curved wave XAFS spectra, phase shifts and effective scattering amplitudes for cluster of atoms.

2423 (ESTSC–000440IBMPC00) **FEFF 5.03: Ab initio X-ray Absorption Fine Structure Code.** Zabinsky, S.I. (University of Washington, Seattle, WA (United States)); Rehr, J.J.; Albers, R.C. Washington Univ., Seattle, WA (United States). 27 Apr 1992. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG06-90ER45415. Source: ESTSC.

Description: IBM PC; Designed to be portable; FORTRAN 77; One 3.5 diskette.

FEFF5.03 calculates single and multiple-scattering curved wave XAFS spectra, phase shifts and effective scattering amplitudes for cluster of atoms.

2424 (ESTSC–000440MNFRM00) **FEFF 5.03: Ab initio X-ray Absorption Fine Structure Code.** Zabinsky, S.I. (University of Washington, Seattle, WA (United States)); Rehr, J.J.; Albers, R.C. Washington Univ., Seattle, WA (United States). 27 Apr 1992. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG06-90ER45415. Source: ESTSC.

Description: MAINFRAMES; Designed to be portable; FORTRAN 77; One 3.5 diskette.

FEFF5.03 calculates single and multiple-scattering curved wave XAFS spectra, phase shifts and effective scattering amplitudes for cluster of atoms.

2425 (ESTSC–000460IPCAT00) **MAILS: Multiple-Aircraft Instantaneous Line Source.** Liebsch, E.J. (Oak Ridge National Lab, TN (United States)); Miller, R.L. Oak Ridge National Lab., TN (United States). 1 Mar 1991. Sponsored by USDOE, Washington, DC (United States); Department of Defense, Washington, DC (United States). DOE Contract AC05-84OR21400. Source: ESTSC.

Description: IBM PC/AT; PC-DOE or MS-DOS; FORTRAN IV; 1 5.25 Diskette.

MAILS is an air-quality screening model, that provides conservative estimates of ground-level pollutant concentrations resulting from aircraft engine emissions along low-altitude (under 3000 ft) military training routes (MTRs). It was developed to evaluate the air-quality impacts of proposed MTRs, in accordance with the environmental-impact analysis requirements of the National Environmental Policy Act of 1969 (NEPA, Pub.L. 91-190).

2426 (ESTSC–000461AL00000) **SXLSQA: For the interpretation of solvent extraction data.** Baes, C.F. Jr (Oak Ridge National Lab., TN (United States)); Moyer, B.A. Oak Ridge National Lab., TN (United States). 8 Jun 1992. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Source: ESTSC.

Description: APPLE MACINTOSH; MACINTOSH FINDER 6.1.5, SYSTEM 6FORTRAN 77; 1 3.5 Diskette. The input and output file names are specified by the program. This software is still under development and has not been completely debugged. Users are requested to report any problems they encounter to aid the authors in improving SXLSQA.

SXLSQA models solvent extraction systems involving an acidic and/or a neutral reagent in an organic solvent that can extract from an aqueous solution one or two cations in addition to H plus and one or two anions in addition to OH minus. In modelling data, any number of product species can be assumed to form in either phase. Activity coefficients of species in the aqueous phase can be calculated by the Pitzer treatment and in the organic phase by Hildebrand-Scott treatment.

2427 (ESTSC–000461D0VAX00) **SXLSQA: For the interpretation of solvent extraction data.** Baes, C.F. Jr (Oak Ridge National Lab., TN (United States)); Moyer, B.A. Oak Ridge National Lab., TN (United States). 8 Jun 1992. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Source: ESTSC.

Description: DEC VAX; VAX; FORTRAN 77; 1 3.5 Diskette. The input and output file names are specified by the program. This software is still under development and has not been completely debugged. Users are requested to report any problems they encounter to aid the authors in improving SXLSQA.

SXLSQA models solvent extraction systems involving an acidic and/or a neutral reagent in an organic solvent that can extract from an aqueous solution one or two cations in addition to H plus and one or two anions in addition to OH minus. In modelling data, any number of product species can be assumed to form in either phase. Activity coefficients of species in the aqueous phase can be calculated by the Pitzer treatment and in the organic phase by Hildebrand-Scott treatment.

2428 (ESTSC–000507C660000) **LASLXSECSETS: Sn 18-24- and 25-group sets.** Mills, C.B. (Los Alamos National Lab., NM (United States)). Los Alamos National Lab., NM (United States). 1 Sep 1963. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (NESC–532). Source: RADIATION SHIELDING INFORMATION CENTER.

Description: CDC6600; SCOPE; FORTRAN IV; 1 Mag Tape.

Group constants and computed neutron cross sections are tabulated for a variety of materials including - Al, B, Be, C, Cd, Cl, D, Ga, F194, Fe, H, K, Li6, Mo, Na, Ni, O, Pu239, Pu240, Pu249, Th, U233, U235, U238, and Zr. These are presented as 18-, 24-, and 25-group calculations for reactors with neutron energies ranging from fast to thermal.

2429 (ESTSC–000508U110000) **ISOTOPES: Maximum yield from reaction or decay.** Furman, A. (Lockheed Missiles and Space Co., Sunnyvale, CA (United States)). Oak Ridge National Lab., TN (United States). 1 Jan 1965. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. (NESC–179). Source: RADIATION SHIELDING INFORMATION CENTER.

Description: UNIVAC1100; EXEC8; FORTRAN V; 1 Mag Tape. The input is unchanged from that described in ORNL-3673, except for the use of one blank card to separate cases and two blank cards to terminate a run.

This program can be used to calculate for any neutron flux the optimum time of irradiation for maximum yield, the specific activity of the product isotope in curies per gram of target material, and the combined specific activity of the target and product isotopes. The product isotope may be produced by any simple reaction such as (n,gamma), (n,p), (n,2n), etc., or it may be produced by decay of a parent isotope.

2430 (ESTSC–000509C007400) **LAYFLO: Radionuclide transport geologic medium.** Gureghian, A.B. (Battelle Memorial Institute, Columbus, OH (United States)); Jansen, G. Battelle Memorial Inst., Columbus, OH (United States). Office of Nuclear Waste Isolation. 1 May 1983. Sponsored by USDOE, Washington, DC (United States). (NESC–1038). Source: ESTSC.

Description: CDC CYBER74; NOS/BE 1.5 (CDC CYBER74); NOS 1.FORTRAN 77; 1 Mag Tape. The VAX version of LAYFLO and auxiliary graphic program mentioned in the ONWI-466 reference report are not available from the authors.

LAYFLO predicts the one-dimensional convective-dispersive and nondispersive transport of a three-member decay chain in a stratified geologic medium. The dispersive solution is restricted to six layers, while the nondispersive solution can handle any number of layers. The accuracy of LAYFLO was tested on a selected number of problems for which analytical solutions or experimental data were available.

2431 (ESTSC–000510I036000) **INCITE: thermal spectra & multi-gp constants.** Curtis, R.L. (EG and G Idaho Inc., Idaho Falls, ID (United States)); Grimesey, R.A. EG and G Idaho, Inc., Idaho Falls, ID (United States). 1 Nov 1967. Sponsored by USDOE, Washington, DC (United States). (NESC–565). Source: RADIATION SHIELDING INFORMATION CENTER.

Description: IBM360; OS/360; FORTRAN IV; 1 Mag Tape.

INCITE generates energy-dependent thermal neutron spectra and appropriate average multigroup cross sections using arbitrary scattering kernels. The physical model is a homogeneous, critical, one-dimensional base slab core.

2432 (ESTSC–000511I036000) **KEFFMGBSTGAN: nuclear criticality safety.** Clark, H.K. (Westinghouse Savannah River Co., Aiken, SC (United States)). Westinghouse Savannah River Co., Aiken, SC (United States). 1 Nov 1967. Sponsored by USDOE, Washington, DC (United States). (NESC–617). Source: RADIATION SHIELDING INFORMATION CENTER.

Description: IBM360; OS/360; FORTRAN IV; 1 Mag Tape.

Three codes for nuclear criticality safety evaluations make up this package. The principal codes are a code for computing the buckling of fissile material moderated by water (MGBS) and a two-group diffusion theory code that uses parameters generated by the buckling code (TGAN). KEFF is an auxiliary code. KEFF computes keff from dimensions and extrapolation distances, or alternative dimensions, volumes, and masses corresponding to values of keff.

2433 (ESTSC–000512I036000) **ISOSEARCH: Isotope production flux, x-sec calc.** Friend, C.W. (Oak Ridge National Lab., TN (United States)); Lewis, R.E.; Jenkins, A.R. Oak Ridge National Lab., TN (United States). 1 Jan 1967. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. (NESC–322). Source: RADIATION SHIELDING INFORMATION CENTER.

Description: IBM360; Machine dependent; FORTRAN IV and BAL; 1 Mag Tape.

The program was developed to calculate the unknown reaction cross section, flux value, or product activity in an isotope-production scheme consisting of two or three nuclides.

2434 (ESTSC–000516C017600) **MMT: 1-d radionuclide ground water transport.** Golis, M.J. (Battelle Memorial Institute, Columbus, OH (United States)). Battelle, Columbus, OH (United States). 1 Apr 1983. Sponsored by USDOE, Washington, DC (United States). (NESC–9853). Source: RADIATION SHIELDING INFORMATION CENTER.

Description: CDC CYBER176; NOS 1.4 (CDC CYBER176); NOS 2 (CFORTRAN 77 (FTN5); 1 Mag Tape. PLTCVT uses routines from the proprietary CalComp library to produce graphical output; these routines are not included.

MMT solves the one-dimensional equation for transport of radionuclides in a ground-water system with uniform velocity and transport properties. The purpose of the code is to evaluate radionuclide release rates from the site subsystem. MMT treats convective transport, sorption-desorption effects, and hydrodynamic dispersion. Sorption and desorption of radionuclides are taken into account by application of retardation factors which are spatially uniform and derived from bulk rock properties and average geochemical data. Dispersion along the direction of flow (forward and backward) is also taken into account. Because the code solves only the one-dimensional transport equation, dispersion transverse to the direction of flow is not evaluated. A discrete parcel random walk (DPRW) approach is used to solve the coupled equations. This numerical technique is inherently stable and minimizes computational errors that lead to apparent mass nonconservation. MMT is a set of three programs which are run sequentially. The first program, MMT1D, utilizes flow and radionuclide input to generate the raw radionuclide release rate output in terms of the frequency at which parcels pass the specified release point and the calculated weights of these parcels. The second program, PLTCVT, is a post-processor which filters and smooths the MMT1D output to reduce the statistical fluctuation. PLTCVT uses a variable-window, moving-average filter algorithm to smooth the raw results. The smoothed output from PLTCVT consists of separate, smoothed output files for each nuclide under consideration. The third program, MERGE, merges the separate release files generated by PLTCVT into a single output file. This merged output file may be used directly by a biosphere transport or dose assessment code as radionuclide release rate input data.

2435 (ESTSC–000517D078000) **MASCOT: Radionuclide decay chain transport.** Gureghian, A.B. (Battelle Memorial Institute, Columbus, OH (United States)). Battelle, Willowbrook, IL (United States). Office of Waste Technology Development. 1 Jul 1988. Sponsored by USDOE, Washington, DC (United States). (NESC–9522). Source: RADIATION SHIELDING INFORMATION CENTER.

Description: DEC VAX11/780; VMS 4.1; VAX FORTRAN; 1 Mag Tape. The MAS-GRF postprocessor requires the proprietary CA-DISSPLA 10.0 software to produce graphical results. MAS-GRF can produce tables if DISSPLA is not available. Both MASCOT and MAS-GRF must be compiled using the FORTRAN compiler option, G-FLOATING, which implements extended-range floating-point arithmetic. Other non-standard FORTRAN 77 features include extended-length symbolic names, the END DO statement, and calls to system DATE and TIME routines.

MASCOT computes the two- and three-dimensional space-time dependent, convective-dispersive transport of a four-member radionuclide decay chain in unbounded homogeneous porous media for constant (step and band) and radionuclide-dependent release. A steady-state isothermal groundwater flow regime is assumed with parallel streamlines along the direction of flow. The solutions are designed for an unbounded medium flow field assumed to be semi-infinite normal to the source and infinite orthogonal to the source with a variety of boundary conditions, including a single or multiple finite line source or a Gaussian-distributed source in the two-dimensional case, and a single or multiple patch source or bivariate-normal distributed source in the three-dimensional case. A postprocessor prográm, MAS-GRF, which produces tables and/or graphs from MASCOT output, is included.

2436 (ESTSC–000518U110800) **TOAD: Processing of analyzer gamma-ray spectra.** Busch, D.D. (General Atomic Co., San Diego, CA (United States)). General Atomics, San Diego, CA (United States). 3 Apr 1968. Sponsored by USDOE, Washington,

DC (United States). (NESC–333). Source: RADIATION SHIELDING INFORMATION CENTER.

Description: UNIVAC1108; EXEC2; GAX33; FORTRAN IV and Assembly language; 1 Mag Tape.

TOAD is used to process and analyze gamma ray spectra.

2437 (ESTSC–000519IPCAT00) **RICKI: Interactive gamma spectral analysis.** Proctor, A.E. (EG and G Idaho Inc., Idaho Falls, ID (United States)). EG and G Idaho, Inc., Idaho Falls, ID (United States). 1 Feb 1987. Sponsored by USDOE, Washington, DC (United States). (NESC–9580). Source: RADIATION SHIELDING INFORMATION CENTER.

Description: IBM PC/AT; DOS 3.1; IBM BASIC 2.01; 1 5.25 Diskette. Because some DOS systems do not allow more than three open files, two RICKI source files are provided. RICKI2 edits the averaged activities and procedures output file (the fourth open file) for use by the CORESORT spreadsheet generation program. RICKI, which does not perform this editing, opens only three files.

RICKI is an interactive program for analysis of gamma spectra containing one or more peaks with possible multiplets. Algorithms are incorporated for peak fitting, analysis, and nuclide identification. Comprehensive output keeps the user informed of the analysis as it proceeds and presents the results. User-selectable options for plotting and neutron activation analysis are available to control this analysis. RICKI was developed to analyze spectra from examinations of severe fuel damage specimens. Two features included to streamline the analysis of Three Mile Island (TMI) core bore data are the edit of averaged activities and the output file created for generating a spreadsheet. Activity editing allows the user to select which gamma lines are used for a specific nuclide in average activity calculations. Contributions from peak areas which result from overlapping lines of two or more nuclides may be removed. For each averaged activity an edited activity file record is written containing the nuclide name, averaged activity, activity standard deviation, scan start position, and scan end position.

2438 (ESTSC–000520I036000) **THERMOS: 30-gp ENDF/B scat kernels.** McCrosson, F.J. (Westinghouse Savannah River Plant, Aiken, SC (United States)); Finch, D.R. Westinghouse Savannah River Co., Aiken, SC (United States). 1 Oct 1971. Sponsored by USDOE, Washington, DC (United States). (NESC–543). Source: RADIATION SHIELDING INFORMATION CENTER.

Description: IBM360; Machine Dependent; Auxiliary program written in FORTRAN IV; 1 Mag Tape.

These data are 30-group THERMOS thermal scattering kernels for P0 to P5 Legendre orders for every temperature of every material from s(alpha,beta) data stored in the ENDF/B library. These scattering kernels were generated using the FLANGE2 computer code (NESC 368). To test the kernels, the integral properties of each set of kernels were determined by a precision integration of the diffusion length equation and compared to experimental measurements of these properties. In general, the agreement was very good. Details of the methods used and results obtained are contained in the reference. The scattering kernels are organized into a two volume magnetic tape library from which they may be retrieved easily for use in any 30-group THERMOS library.

2439 (ESTSC–000521GE63500) **REAX: Resolved resonance epithermal x-sections.** Protsik, R. (General Electric Co., Sunnyvale, CA (United States)). General Electric Co., San Jose, CA (United States). Nuclear Energy Products Div. 1 Apr 1966. Sponsored by USDOE, Washington, DC (United States). (NESC–257). Source: RADIATION SHIELDING INFORMATION CENTER.

Description: GE635; GE635 GECOS; FORTRAN IV; 1 Mag Tape.

REAX calculates epithermal flux, activities and cross sections as a function of radius and energy for a constant temperature fuel rod immersed in a homogeneous medium.

2440 (ESTSC–000522I036000) **REBUS2: Fuel cycle analysis for fast reactors.** Toppel, B.J. (Argonne National Lab., IL (United States)). Argonne National Lab., IL (United States). 1 Oct 1978. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (NESC–634). Source: ESTSC.

Description: IBM360; OS/360;370; FORTRAN IV (99%) and Assembly language (1%); 1 Mag Tape.

REBUS2 is a system of codes designed for the analysis of fast reactor fuel cycles. Two basic types of analysis problems are solved–the infinite-time, or equilibrium, conditions of a reactor operating under a fixed fuel management scheme, and the explicit cycle-by-cycle, or nonequilibrium, operation of a reactor under a specified periodic fuel management program. For the equilibrium type problems, the code uses specified external fuel supplies to load the reactor. Optionally, reprocessing may be included in the specification of the external fuel cycle and discharged fuel may be recycled back into the reactor. For non-equilibrium cases, the initial composition of the reactor core may be explicitly specified or the core may be loaded from external feeds as in equilibrium problems. Three types of search procedures may be carried out in order to satisfy user-supplied constraints - (a) adjustment of the reactor burn cycle time to achieve a specified discharge burnup, (b) adjustment of the fresh fuel enrichment to achieve a specified multiplication constant at a specified point during the burn cycle, and (c) adjustment of the control poison density to maintain a specified value of the multiplication constant throughout the reactor burn cycle.

2441 (ESTSC–000522MNFRM00) **REBUS2: Fuel cycle analysis for fast reactors.** Toppel, B.J. (Argonne National Lab., IL (United States)). Argonne National Lab., IL (United States). 1 Oct 1978. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (NESC–634). Source: ESTSC.

Description: MAINFRAMES; OS/360;370; FORTRAN IV (99%) and Assembly language (1%); 1 Mag Tape. This version is for non IBM 360 users.

REBUS2 is a system of codes designed for the analysis of fast reactor fuel cycles. Two basic types of analysis problems are solved–the infinite-time, or equilibrium, conditions of a reactor operating under a fixed fuel management scheme, and the explicit cycle-by-cycle, or nonequilibrium, operation of a reactor under a specified periodic fuel management program. For the equilibrium type problems, the code uses specified external fuel supplies to load the reactor. Optionally, reprocessing may be included in the specification of the external fuel cycle and discharged fuel may be recycled back into the reactor. For non-equilibrium cases, the initial composition of the reactor core may be explicitly specified or the core may be loaded from external feeds as in equilibrium problems. Three types of search procedures may be carried out in order to satisfy user-supplied constraints - (a) adjustment of the reactor burn cycle time to achieve a specified discharge burnup, (b) adjustment of the fresh fuel enrichment to achieve a specified multiplication constant at a specified point during the burn cycle, and (c) adjustment of the control poison density to maintain a specified value of the multiplication constant throughout the reactor burn cycle.

2442 (ESTSC–000523C760000) **UCBNE25: radionuclide migration geologic media.** Kilshtok, G. (Battelle Columbus Labs., OH (United States)). Battelle, Columbus, OH (United States). 1 Oct 1980. Sponsored by USDOE, Washington, DC (United States). (NESC–9667). Source: RADIATION SHIELDING INFORMATION CENTER.

Description: CDC7600; NOS; FORTRAN (CDC FTN5); 1 Mag Tape.

UCBNE25 estimates the maximum concentration of nuclides occurring during the migration of three-member radionuclide chains in geologic media without axial dispersion. Unlike other migration codes, the release rate in UCBNE25 is the independent variable, and time is the dependent variable. The extrema in concentrations are determined without having to calculate the entire concentration history. The program assumes one-dimensional water transport and sorption equilibrium for the nuclides in the soil and in the water. The water velocity is held constant, and the leach times are smaller than the half-lives of the nuclides involved. UCBNE25 calculates for each nuclide the time of the maxima at a specified position, the maximum dimensionless concentration, the corresponding water dilution rate, and the contamination time for that position. The closed form solutions can be easily checked by hand, making it a useful calibration tool for other codes.

2443 (ESTSC–000524D078000) **UCBNE10.4: radionuclide migration porous media.** Pigford, T.H. (University of California, Berkeley, CA (United States)); Light, W.B. California Univ., Berkeley, CA (United States). Dept. of Nuclear Engineering. 1 Feb 1980.

Sponsored by USDOE, Washington, DC (United States). (NESC–9668). Source: RADIATION SHIELDING INFORMATION CENTER.

Description: DEC VAX11/780; NOS; FORTRAN 77; 1 Mag Tape.

UCBNE10.2 calculates the one-dimensional migration of radionuclides in a three-member chain in a geological medium saturated with ground water. The geological medium is considered to be a composite material, which consists of solid and liquid phases, and the transport of radionuclides along the interface between the two phases is neglected. The various possible release modes which can be considered include the band, the step, the preferential release, and the exponential. Radioactive waste is viewed as consisting of radionuclides dispersed through a solid matrix. A finite dissolution rate of the waste material results in a band release of radionuclides into the ground water; it is assumed that all of the waste material begins to dissolve at time, t=0, and dissolution is complete with a leach time, T. When the band-release time T approaches infinity, the release mode becomes a step release; it is assumed that the waste material dissolves at a finite rate over an infinite period. On physical grounds, waste material may reasonably be expected to dissolve at an infinitesimal rate in the case of a step release. The preferential release mode assumes that each radionuclide leaches from the waste at a constant fractional rate which is nuclide-dependent. If all species dissolve at the same fractional rate, i.e. all have the same fractional rate constant, this becomes the exponential release mode. Either of two forms of output may be selected. The first produces normalized nuclide and radioactivity concentrations; the second generates radioactivity and ingestion hazard discharge rates.

2444 (ESTSC–000525IBMPC00) **COSTSAFR3.0: Yearly energy costs for buildings.** Lucas, R. (Battelle Pacific Northwest Lab., Richland, WA (United Sates)). Pacific Northwest Lab., Richland, WA (United States). 1 Jun 1988. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (NESC–9405). Source: ESTSC.

Description: IBM PC; MS DOS 2.0 or later; C; 4 5.25 Diskettes. Key Software Products Optimizer (Version 2.5h) is needed to link the code due to the size of the code.

COSTSAFR3.0 generates a set of compliance forms which will be attached to housing Requests for Proposals (RFPs) issued by Departments or Agencies of the Federal Government. The compliance forms provide a uniform method for estimating the total yearly energy cost for each proposal. COSTSAFR3.0 analyzes specific housing projects at a given site, using alternative fuel types, and considering alternative housing types. The program is designed around the concept of minimizing overall costs through energy conservation design, including first cost and future utility costs, and establishes a standard design to which proposed housing designs are compared. It provides a point table for each housing type that can be used to determine whether a proposed design meets the standard and how a design can be modified to meet the standard.

2445 (ESTSC–000528C660000) **RAMP1: Reich-Moore resolved region x-sections.** Bhat, M.R. (Brookhaven National Lab., Upton, NY (United States)). Brookhaven National Lab., Upton, NY (United States). 1 Dec 1971. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (NESC–492). Source: RADIATION SHIELDING INFORMATION CENTER.

Description: CDC6600; SCOPE 3.0; FORTRAN IV; 1 Mag Tape.

RAMP1 calculates scattering, capture, fission, and total cross sections from Reich-Moore resolved resonance parameters. The resonance parameters are assumed to be in ENDF/B Version II data format. Cross sections may be Doppler-broadened if so desired.

2446 (ESTSC–000531C760000) **SCAP: Point kernel single or albedo scatter.** Disney, R.K. (Westinghouse Electric Corp., Madison, PA (United States)); Bevan, S.E. Westinghouse Electric Corp., Madison, PA (United States). Advanced Reactors Div. 1 Feb 1981. Sponsored by USDOE, Washington, DC (United States). (NESC–933). Source: ESTSC.

Description: CDC7600; SCOPE 2.1 (CDC7600); NOS 1.3 (CDC-FORTRAN (99%) and COMPASS (1%); 1 Mag Tape. Subroutine RFLS, which allocates the requested small core memory (SCM), is written in CDC COMPASS assembly language.

SCAP solves for radiation transport in complex geometries using the single or albedo-scatter point kernel method. The program is designed to calculate the neutron or gamma-ray radiation level at detector points located within or outside a complex radiation scatter source geometry or a user-specified discrete scattering volume. The geometry is described by zones bounded by intersecting quadratic surfaces with an arbitrary maximum number of boundary surfaces per zone. The anisotropic point sources are described as pointwise energy dependent distributions of polar angles on a meridian; isotropic point sources may be specified also. The attenuation function for gamma rays is an exponential function on the primary source leg and the scatter leg with a buildup factor approximation to account for multiple scatter on the scatter leg. The neutron attenuation function is an exponential function using neutron removal cross sections on the primary source leg and scatter leg. Line or volumetric sources can be represented as distributions of isotropic point sources, with uncollided line-of-sight attenuation and buildup calculated between each source point and the detector point.

2447 (ESTSC–000533C018000) **WIMS-D/4: Multigroup reactor lattice cell calculation.** Roth, M.J. (United Kingdom Atomic Energy Authority, Winfrith (United Kingdom)). Brookhaven National Lab., Upton, NY (United States). 1 Dec 1989. Sponsored by UKAEA Headquarters, London (United Kingdom). (NESC–NEA0329). Source: ESTSC.

Description: CDC CYBER180; NOS 4.3; FORTRAN 77; 1 Mag Tape. Memory must be preset to zero prior to running WIMS-D/4 on a CDC.

WIMS, the Winfrith Improved Multigroup Scheme, is a general program for reactor lattice cell calculations over a wide range of reactor systems. The program accepts rod or plate fuel geometries in either regular arrays or in clusters, and the energy group structure has been chosen for both thermal and fast reactor calculations. The basic library has been compiled with 14 fast groups, 13 resonance groups and 42 thermal groups, but the user is offered the choice of accurate solutions in many groups or rapid calculations in few groups. Temperature dependent thermal scattering matrices for a variety of scattering laws are available in the library for the principal moderators including hydrogen, deuterium, graphite, beryllium and oxygen. The output provides eigenvalues for cases where a simple buckling mode is applicable or cell-averaged parameters for use in overall reactor calculations. Various reaction rate edits are produced for direct comparison with experimental measurements. An auxiliary program WRITER translates the library data from decimal to binary format.

2448 (ESTSC–000533DVX1100) **WIMS-D/4: Multigroup reactor lattice cell calculation.** Roth, M.J. (United Kingdom Atomic Energy Authority, Winfrith, (United Kingdom)). Brookhaven National Lab., Upton, NY (United States). 1 Dec 1989. Sponsored by UKAEA Headquarters, London (United Kingdom). (NESC–NEA0329). Source: ESTSC.

Description: DEC VAX11; VMS; FORTRAN 77; 1 Mag Tape. The DEC VAX version includes WIMSLIB, an extension of the WIMS library for PWR calculations. Control rod materials (Ag, In, Cd) were added or replaced; new data for H, Pu-241, U-235, and U-238 are included; and some materials: H(ID=4001), D(4002, 5002, 8002, 9002), B(1010, 1011), Th-232(232, 1232), U-233(233), U-238(238,1238), Pu-239(239, 1239, 2239), and Pu-241(240) were removed. WRITER is used to generate the WIMSLIB binary library.

WIMS, the Winfrith Improved Multigroup Scheme, is a general program for reactor lattice cell calculations over a wide range of reactor systems. The program accepts rod or plate fuel geometries in either regular arrays or in clusters, and the energy group structure has been chosen for both thermal and fast reactor calculations. The basic library has been compiled with 14 fast groups, 13 resonance groups and 42 thermal groups, but the user is offered the choice of accurate solutions in many groups or rapid calculations in few groups. Temperature dependent thermal scattering matrices for a variety of scattering laws are available in the library for the principal moderators including hydrogen, deuterium, graphite, beryllium and oxygen. The output provides eigenvalues for cases where a simple buckling mode is applicable or cell-averaged parameters for use in overall reactor calculations. Various reaction rate edits are produced for direct comparison with experimental measurements.

An auxiliary program WRITER translates the library data from decimal to binary format.

2449 (ESTSC–000533I309000) **WIMS-D/4: Multigroup reactor lattice cell calculation.** Roth, M.J. (United Kingdom Atomic Energy Authority, Winfrith, (United Kingdom)). Brookhaven National Lab., Upton, NY (United States). 1 Dec 1989. Sponsored by UKAEA Headquarters, London (United Kingdom). (NESC–NEA0329). Source: ESTSC.

Description: IBM3090; MVS/XA (IBM3090); VM/CMS (IBM433FORTRAN 77 (97%) and BAL (3%); 1 Mag Tape. The IBM version of WIMS-D/4 uses subroutines ZA02AS, ZA08AS, and ZA09AS from the U.K.A.E.A. Harwell Subroutine Library. These routines, included as part of the package with Harwell's permission, are not in the public domain and extraction for other uses is not permitted.

WIMS, the Winfrith Improved Multigroup Scheme, is a general program for reactor lattice cell calculations over a wide range of reactor systems. The program accepts rod or plate fuel geometries in either regular arrays or in clusters, and the energy group structure has been chosen for both thermal and fast reactor calculations. The basic library has been compiled with 14 fast groups, 13 resonance groups and 42 thermal groups, but the user is offered the choice of accurate solutions in many groups or rapid calculations in few groups. Temperature dependent thermal scattering matrices for a variety of scattering laws are available in the library for the principal moderators including hydrogen, deuterium, graphite, beryllium and oxygen. The output provides eigenvalues for cases where a simple buckling mode is applicable or cell-averaged parameters for use in overall reactor calculations. Various reaction rate edits are produced for direct comparison with experimental measurements. An auxiliary program WRITER translates the library data from decimal to binary format.

2450 (ESTSC–000534MNFRM00) **CPS: FNAL cooperative processes software tools.** Biel, J. (Fermi National Accelerator Lab., Batavia, IL (United States)); Isley, M.; Edel, M.; Miranda, M.; Paiva, E. Fermi National Accelerator Lab., Batavia, IL (United States). 1 Mar 1989. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. (NESC–9429). Source: ESTSC.

Description: MAINFRAMES; UNIX, ULTRIX,VMS (DEC VAX).; C; 1 Mag Tape.

CPS (Cooperative Processes Software) is a set of software tools for designing applications in which multiple CPUs act on a problem in a cooperative way. CPS is useful on problems which are event-oriented, i.e., they exhibit obvious large degrees of parallelism with loose coupling between individual processes. High energy physics event analysis and triggering farm applications fit this description. Primary tools are a Job Manager program and a set of subroutines. The Job Manager starts the processes, provides common support services, handles errors that occur, keeps track of bookkeeping (state) information about what each process is doing, and stops the processes when the task is over. The subroutines provide mechanisms for interprocess communication, remote subroutine calls, and synchronization.

2451 (ESTSC/NRC–000092I303300) **REFCO83: Nuclear fuel cycle cost economics.** Delene, J.G. (Oak Ridge National Lab., TN (United States)); Hermann, O.W. Oak Ridge National Lab., TN (United States). 1 Jun 1984. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research. (NESC–9820). Source: ESTSC.

Description: IBM3033; OS/MVT;MVS; FORTRAN IV; 1 Mag Tape. A dummy error routine was added to the software to resolve an external call to ERROR. Format statements were fixed to resolve errors of comma placement. The test output was off in precision by only an insignificant fraction.

REFCO83 utilizes a discounted cash flow (DCF) analysis procedure to calculate batch, cycle, and lifetime levelized average nuclear fuel cycle costs. The DCF analysis establishes an energy 'cost' associated with the fuel by requiring that the revenues from the sale of energy be adequate to pay the required return on outstanding capital, to pay all expenses including taxes, and to retire the outstanding investment to zero by the end of the economic life of the set of fuel investments. The program uses reactor mass flow information together with individual fuel cost parameters and utility capital structure and money costs to calculate levelized costs cumulatively through any batch or cycle. A fuel cycle cost component is considered to be any fuel material purchase, processing cost, or discharge material credit in the complete fuel cycle. The costs for each individual component, i.e. uranium, enrichment, etc., may either be expensed or capitalized for tax purposes or, in the case of waste disposal, the cost may also be made proportional to power production. To properly account for the effect of income taxes, all calculations in REFCO83 are done using 'then' current dollars, including price escalations caused by inflation. The database used for the default values for REFCO83 was taken from the Nuclear Energy Cost Data Base. The maximum number of fuel batches is 120. A typical REFCO83 calculation requires about one second of CPU time. REFCO83 is an outgrowth of the original REFCO program, written in the early 1970s, and later releases including the POWERCO and REFCO8 programs.

2452 (INIS-BR–2933, pp. 306) **A simple and didactic computer code for adjusting spectra courses.** Barros Melo, W.L. (UNESP, Ilha Solteira, SP (Brazil)); Nascimento, O.R. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. SPECTRA/computer codes; COMPUTER CALCULATIONS; ELECTRON SPIN RESONANCE; ENERGY-LEVEL TRANSITIONS; SPECTRA

2453 (INIS-BR–2933, pp. 308) **Simulation of magnetic resonance spectra.** Goncalves, W.M. (Sao Paulo Univ., SP (Brazil). Inst. de Fisica); Pontuschka, W.M.; Sartorelli, J.C. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1991. 201p. (In Portuguese). (CONF-9105355–: 14. national meeting on condensed matter physics, Caxambu (Brazil), 7-11 May 1991). In *Proceedings of the 14. National Meeting on Condensed Matter Physics. v.2.* Order Number DE93604743. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. COMPUTERIZED SIMULATION/nmr spectra; ALGORITHMS; ARSENIC OXIDES; COMPUTER CALCULATIONS; COMPUTER CODES; FORTRAN; GLASS; HAMILTONIANS; IBM COMPUTERS; SPIN

2454 (INIS-BR–2942, pp. 23) **A new library of cross sections generators codes adapted to fast neutron spectra calculation.** Santo, A.C.F. de (Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Div. de Fisica de Reatores). Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1989. 147p. (In Portuguese). In *Triennial technical report - 1986, 1987, 1988 - Instituto de Engenharia Nuclear (IEN) -Dept. of Reactors (DERE).* Order Number DE93605069. Source: OSTI; NTIS (US Sales Only); INIS.

Published in full form as CT-DIFIR 06/87.

Published in summary form only. NEUTRON SPECTRA/cross sections; NEUTRON SPECTRA/g codes; BILATERAL AGREEMENTS; BRAZILIAN CNEN; COMPUTER CALCULATIONS; ITALIAN ENEA

2455 (INIS-BR–2942, pp. 29) **Execution of CP1 code at CNEN H-Bull computer.** Couto, R.T. (Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Div. de Fisica de Reatores). Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1989. 147p. (In Portuguese). In *Triennial technical report - 1986, 1987, 1988 - Instituto de Engenharia Nuclear (IEN) -Dept. of Reactors (DERE).* Order Number DE93605069. Source: OSTI; NTIS (US Sales Only); INIS.

Published in full form as CT-DIFIR 16/87.

Published in summary form only. BRAZILIAN CNEN/honeywell computers; C CODES; PROGRAMMING; REACTOR KINETICS EQUATIONS; TEMPERATURE DEPENDENCE

2456 (INIS-BR–2942, pp. 32) **Development and utilization of computer programs to the nuclear measures laboratory.** Furieri, R.C.A.A. (Instituto de Engenharia Nuclear (IEN), Rio de

Janeiro, RJ (Brazil). Div. de Fisica de Reatores). Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1989. 147p. (In Portuguese). In *Triennial technical report - 1986, 1987, 1988 - Instituto de Engenharia Nuclear (IEN) -Dept. of Reactors (DERE).* Order Number DE93605069. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. LABORATORIES/computer calculations; E CODES; F CODES; GAMMA RADIATION; GOLD; LABORATORIES; LI-DRIFTED GE DETECTORS; NEUTRON FLUX; PERFORMANCE; THERMAL NEUTRONS

2457 (INIS-BR–2942, pp. 38) **Modification in the Hammer code to get cross sections by isotopes at 4 energy groups.** Santo, A.C.F. de (Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Div. de Fisica de Reatores); Mesquita, M.E. Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1989. 147p. (In Portuguese). In *Triennial technical report - 1986, 1987, 1988 - Instituto de Engenharia Nuclear (IEN) -Dept. of Reactors (DERE).* Order Number DE93605069. Source: OSTI; NTIS (US Sales Only); INIS.

Published in full form as CT-DIFIR 06/88.

Published in summary form only. H CODES/cross sections; COMPUTER CALCULATIONS; MODIFICATIONS; MULTIGROUP THEORY; PROGRAMMING

2458 (INIS-BR–2942, pp. 40) **Validation of WIMSTRACA code.** Santo, A.C.F de (Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Div. de Fisica de Reatores); Waintraub, M. Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1989. 147p. (In Portuguese). In *Triennial technical report - 1986, 1987, 1988 - Instituto de Engenharia Nuclear (IEN) -Dept. of Reactors (DERE).* Order Number DE93605069. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. REACTOR CELLS/computer calculations; BENCHMARKS; NEUTRON SPECTRA; PERFORMANCE TESTING; VERIFICATION; W CODES

2459 (INIS-BR–2942, pp. 65-66) **Optimization of the TV-CTS-1 calculation code.** Cesar, S.B.G. (Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores). Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1989. 147p. (In Portuguese). In *Triennial technical report - 1986, 1987, 1988 - Instituto de Engenharia Nuclear (IEN) -Dept. of Reactors (DERE).* Order Number DE93605069. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. COOLANT LOOPS/ programming; PROGRAMMING; FINITE DIFFERENCE METHOD; OPTIMIZATION; SODIUM; T CODES; TIME DEPENDENCE

2460 (INIS-BR–2942, pp. 90) **Implantation and con validation of the computer program TERM for thermal analysis of axisymmetric bidimensional structures.** Cruz, J.R.B. (Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores); Araujo, U.P. de. Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1989. 147p. (In Portuguese). In *Triennial technical report - 1986, 1987, 1988 - Instituto de Engenharia Nuclear (IEN) -Dept. of Reactors (DERE).* Order Number DE93605069. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. THERMAL ANALYSIS/heat transfer; COMPUTER CALCULATIONS; STEADY-STATE CONDITIONS; T CODES; TRANSIENTS; VERIFICATION

2461 (INIS-BR–2942, pp. 100) **POS2D: a graphic program for analyzing axisymmetric and two-dimensional structures.** Cruz, J.R.B. (Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores); Araujo, U.P. de. Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1989. 147p. (In Portuguese). In *Triennial technical report - 1986, 1987, 1988 - Instituto de Engenharia Nuclear (IEN) -Dept. of Reactors (DERE).* Order Number DE93605069. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. COMPUTER GRAPHICS/finite element method; COMPUTER GRAPHICS/mechanical structures; COMPUTER CALCULATIONS; DEFORMATION; P CODES; STRESSES; TWO-DIMENSIONAL CALCULATIONS

2462 (INIS-mf–13349, pp. 7-8) **Computer codes specifications for simulating nuclear reactions.** Shookohi, F. (Atomic Energy Organization of Iran, Teheran (Iran, Islamic Republic of). Nuclear Research Centre); Pishgo, A.; Afarideh, H. Iranian Physics Society, Teheran (Iran, Islamic Republic of). 1991. 53p. (In Persian). (CONF-9109417–: Iran's physics conference, Isfahan (Iran, Islamic Republic of), 10 Sep 1991). In *Abstract of articles from Iran's physics conference.* Order Number DE93000811. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. NUCLEAR REACTIONS/computerized simulation; ENERGY LOSSES; LEAST SQUARE FIT

2463 (INIS-mf–13349, pp. 45) **Introducing DISP computer code.** Shams, M. (Sharif Univ. of Technology, Teheran (Iran, Islamic Republic of)); Afshar Bekeshloo, A. Iranian Physics Society, Teheran (Iran, Islamic Republic of). 1991. 53p. (In Persian). (CONF-9109417–: Iran's physics conference, Isfahan (Iran, Islamic Republic of), 10 Sep 1991). In *Abstract of articles from Iran's physics conference.* Order Number DE93000811. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. D CODES/fission product release; D CODES/reactor accidents; BODY; ENVIRONMENTAL IMPACTS; FORTRAN; LUNGS; RADIATION DOSES; SKELETON; THYROID

2464 (INP–1496/PH) **Intermittency analysis of correlated data.** Wosiek, B. KLM Collaboration. Institute of Nuclear Physics, Cracow (Poland). 15 Sep 1992. 15p. Order Number DE93604068. Source: OSTI; NTIS (US Sales Only); INIS.

We describe the method of the analysis of the dependence of the factorial moments on the bin size in which the correlations between the moments computed for different bin sizes are taken into account. For large multiplicity nucleus-nucleus data inclusion of the correlations does not change the values of the slope parameter, but gives errors significantly reduced as compared to the case of fits with no correlations. (author).

2465 (JINR-E–5-91-401) **A REDUCE program for symbolic computation of Puiseux expansions.** Gerdt, V.P.; Tiller, P. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Computing Techniques and Automation. 1991. 8p. Order Number DE93606014. Source: OSTI; NTIS (US Sales Only); INIS.

The program is described for computation of Puiseux expansions of algebraic functions. The Newton diagram method is used for construction of initial coefficients of all the Puiseux series at the given point. The program is written in computer algebra language Reduce. Some illustrative examples are given. 20 refs.

2466 (JINR-E–10-91-434) **ANS - the analysis of the neutron spectra.** Ivanov, B.I.; Rosek, J. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems. 1991. 10p. Order Number DE93606013. Source: OSTI; NTIS (US Sales Only); INIS.

The program ANS which is the graphical user friendly program to process evaluated neutron data files for interpretation of transmission experiments. The ANS program was written in the Turbo Pascal v. 5 language and may work on the IBM AT with Math Co-Processor. 3 refs.; 1 fig.

2467 (JINR-R–11-91-327) **Investigation of the increased accuracy order difference schemes for the scattering problem at the quasi-uniform mesh.** Vinitskij, S.I.; Puzynin, I.V.; Smirnov, Yu.S. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Computing Techniques and Automation. 1991. 14p. (In Russian). Order Number DE93606011. Source: OSTI; NTIS (US Sales Only); INIS.

An iteration algorithm for solving the scattering problem is proposed, such that uses the increased accuracy order difference schemes at the quasi-uniform mesh. The dependence of calculated phase shifts on the quasi-uniform mesh structure is investigated. The borders of the increased accuracy order difference schemes application in the scattering problem is defined. The calculation of the location and the width of the $^1P_{0(2.1)}{}^0$+H$^-$ form resonance is executed with the help of the present algorithm. 5 refs.; 7 figs.; 2 tabs.

2468 (LA–12353-MS) **Back propagation neural networks for facial verification.** Garnett, A.E. (ed.); Solheim, I.; Payne, T.;

Castain, R.H. Los Alamos National Lab., NM (United States). Oct 1992. 60p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE93001428. Source: OSTI; NTIS; GPO Dep.

We conducted a test to determine the aptitude of neural networks to recognize human faces. The pictures we collected of 511 subjects captured both profiles and many natural expressions. Some of the subjects were wearing glasses, sunglasses, or hats in some of the pictures. The images were compressed by a factor of 100 and converted into image vectors of 1400 pixels. The image vectors were fed into a back propagation neural network with one hidden layer and one output node. The networks were trained to recognize one target person and to reject all other persons. Neural networks for 37 target subjects were trained with 8 different training sets that consisted of different subsets of the data. The networks were then tested on the rest of the data, which consisted of 7000 or more unseen pictures. Results indicate that a false acceptance rate of less than 1 percent can be obtained, and a false rejection rate of 2 percent can be obtained when certain restrictions are followed.

2469 (LA-UR–92-1753) **High speed networks, visualization, and massive parallelism in the Advanced Computing Laboratory.** Forslund, D.W.; Hansen, C.; Hinker, P.; St. John, W.; Tenbrink, S. Los Alamos National Lab., NM (United States). [1992]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-921210–2: Symposium for high-performance computing for flight vehicles, Washington, DC (United States), 7-9 Dec 1992). Order Number DE92017412. Source: OSTI; NTIS; GPO Dep.

Very high performance massively parallel machines are now available to solve significant problems for the nation that have been heretofore inaccessible. However, these machines, with their large memories are of little use for these problems without existing in an environment in which the scientist can perceive what is happening in the calculation and analyze the results effectively. This requires being able to transmit enormous amounts of data from these machines through very high performance networks in a way which is easily comprehended and manipulated by the scientist. In order to provide such an environment for these Grand Challenge applications, researchers in the Advanced Computing Laboratory have been developing a very high speed network (100 Mbytes/sec) based on the standard HIPPI protocol developed at Los Alamos. This is used to send data over a multiple crossbar network between supercomputers, high performance graphics machines, and high speed framebuffers. Examples of scientific problems being explored in this way will be given, including approaches to high speed archival data storage and interactive data exploration over these networks.

2470 (LA-UR–92-2338) **Latin hypercube sampling as a tool in uncertainty analysis of computer models.** McKay, M.D. Los Alamos National Lab., NM (United States). [1992]. 9p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-921219–1: 1992 winter simulation conference, Arlington, VA (United States), 13-16 Dec 1992). Order Number DE92018917. Source: OSTI; NTIS; GPO Dep.

This paper addresses several aspects of the analysis of uncertainty in the output of computer models arising from uncertainty in inputs (parameters). Uncertainty of this type, which is separate and distinct from the randomness of a stochastic model, most often arises when input values are guesstimates, or when they are estimated from data, or when the input parameters do not actually correspond to observable quantities, e.g., in lumped-parameter models. Uncertainty in the output is quantified in its probability distribution, which results from treating the inputs as random variables. The assessment of which inputs are important with respect to uncertainty is done relative to the probability distribution of the output.

2471 (LBL–32512) **Monte Carlo simulations on SIMD computer architectures.** Burmester, C.P. (Lawrence Berkeley Lab., CA (United States)); Gronsky, R.; Wille, L.T. Lawrence Berkeley Lab., CA (United States). Mar 1992. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-920402–60: 1992 Material Research Society (MRS) spring meeting, San Francisco, CA (United States), 27 Apr - 2 may 1992). Order Number DE92041210. Source: OSTI; NTIS; GPO Dep.

Algorithmic considerations regarding the implementation of various materials science applications of the Monte Carlo technique to single instruction multiple data (SMM) computer architectures are presented. In particular, implementation of the Ising model with nearest, next nearest, and long range screened Coulomb interactions on the SIMD architecture MasPar MP-1 (DEC mpp-12000) series of massively parallel computers is demonstrated. Methods of code development which optimize processor array use and minimize inter-processor communication are presented including lattice partitioning and the use of processor array spanning tree structures for data reduction. Both geometric and algorithmic parallel approaches are utilized. Benchmarks in terms of Monte Carlo updates per second for the MasPar architecture are presented and compared to values reported in the literature from comparable studies on other architectures.

2472 (NIPER–596) **General-purpose automation programming: A case study on using a graphic language.** Mahmood, S.M.; Olsen, D.K. National Inst. for Petroleum and Energy Research, Bartlesville, OK (United States). Oct 1992. 42p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC22-83FE60149. Order Number DE92001071. Source: OSTI; NTIS; GPO Dep.

Object-oriented programming is the future direction of computer programming and automation. It provides fast, easy and very reliable methodology for developing large complicated software programs to test prototype configurations and develop computer control of multiple operations. This report is part of technology transfer to assist the petroleum industry and other engineering, science and manufacturing areas by conveying background information and the benefits of this approach that were acquired during development of the data acquisition/control/analysis/presentation software to operate a high-temperature, high-pressure steamflood laboratory. NIPER developed the background and extensive applications using object-oriented programming software using National Instruments™ LabVIEW®2 as the programming platform. The objective of developing this software was to automate the thermal lab; however, it was designed in such a way that the program would be general and could be configured to any laboratory automation during the run time. This modular program has been constructed so that application, with minor modification, can be used in other laboratory, pilot plant or commercial operations for data acquisition/control/analysist/presentation.

2473 (ORNL/TM–12045) **Exploratory designs for computational experiments.** Morris, M.X.; Mitchell, T.J. Oak Ridge National Lab., TN (United States). Oct 1992. 39p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93002354. Source: OSTI; NTIS; GPO Dep.

Recent work by Johnson, Moore and Ylvisaker (1990) establishes equivalence of the maximin distance design criterion and an entropy criterion motivated by function prediction in a Bayesian setting. The latter criterion has been used by Currin, Mitchell, Morris, and Ylvisaker (1991) to design experiments for which the motivating application is approximation of a complex deterministic computer model. Because computer experiments often have a large number of controlled variables (inputs), maximin designs of moderate size are often concentrated in the corners of the cuboidal design region, i.e. each input is represented at only two levels. Here we will examine some maximin distance designs constructed within the class of Latin hypercube arrangements. The goal of this is to find designs which offer a compromise between the entropy/maximin criterion, and good projective properties in each dimension (as guaranteed by Latin hypercubes). A simulated annealing search algorithm is persented for constructing these designs, and patterns apparent in the optimal designs are discussed.

2474 (ORNL/TM–12125) **A new PICL trace file format.** Worley, P.H. Oak Ridge National Lab., TN (United States). Oct 1992. 35p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93002355. Source: OSTI; NTIS; GPO Dep.

A trace file format is described that will be used in future releases of the Portable Instrumented Communication Library (PICL)

and ParaGraph. The new format provides improved support for tracing and profiling PICL communication primitives and user-defined events. The new format is also easily extended and may be useful in other instrumentation packages and performance visualization tools.

2475 (SAND–92-0508) **Verification of the computer programs SLAAP and DATA.** Cawlfield, J.L.; Smith, E.L. Sandia National Labs., Albuquerque, NM (United States). Oct 1992. 48p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93002597. Source: OSTI; NTIS; GPO Dep.

The computer programs SLAAP and DATA are currently being used by Division 2743 for data analysis. These programs had not been previously verified to determine if they were producing correct results. The objective of the study described in this report was to verify these programs by comparing their results to those obtained with GRAFAID, a verified data analysis program. To accomplish this, five acceleration-time histories were selected. For each time history, the shock response spectrum, integral, double integral, derivative and Fourier transform were computed using SLAAP, DATA and GRAFAID. The results of each operation for each time history were overlay plotted for comparison. The results show only minor differences in some cases. These differences are deterministic and are due to differences in the algorithms or block size restrictions of the three programs.

2476 (SAND–92-0962C) **The Sandia Airborne Computer (SANDAC).** Nava, E.J. Sandia National Labs., Albuquerque, NM (United States). [1992]. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-921210–1: Symposium for high-performance computing for flight vehicles, Washington, DC (United States), 7-9 Dec 1992). Order Number DE92014046. Source: OSTI; NTIS; GPO Dep.

The Sandia Airborne Computer (SANDAC) is a small, modular, high performance, multiprocessor computer originally designed for aerospace applications. It can use a combination of Motorola 68020 and 68040 based processor modules along with AT&T DSP32C based signal processing modules. The system is designed to use up to 15 processors in almost any combination and a complete system can include up to 20 modules. Depending on the mix of processors, total computational throughput can range from 2.5 to greater than 225 Million Instructions Per Second (MIPS). The system is designed so that processors can access all resources in the machine and the inter-processor communication details are completely transparent to the software. In addition to processors, the system includes input/output, memory, and special function modules. Because of its ease of use, small size, durability, and configuration flexibility, SANDAC has been used on applications ranging from missile navigation, guidance, and control systems to medical imaging systems.

2477 (SAND–92-1452) **The performance of PAGOSA on several SIMD and MIMD parallel computers.** Gardner, D.R. (Sandia National Labs., Albuquerque, NM (United States)); Cline, D.D.; Vaughan, C.T.; Krall, R.; Lewitt, M. Sandia National Labs., Albuquerque, NM (United States). Oct 1992. 48p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93002599. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The performance of a single-material version of the PAGO SA code has been measured on various parallel computers. The single-material version of PAGOSA is a three-dimensional, explicit, Eulerian hydrocode for modeling the high-speed hydrodynamic flow of an ideal gas, and was developed at Los Alamos National Laboratory for the Connection Machine-2 (CM-2) massively parallel computer. The performance of the original data-parallel version has been measured on two SIMD machines, the CM-2 and the CM-5, and the performance of a message-passing version developed by Sandia has been measured on five MIMD machines: the Cray Y-MP, the nCUBE 2, the Intel iPSC/860, the Intel Touchstone DELTA, and the CM-5. No special efforts were made to optimize the codes for any particular machine, except that the version Of PAGOSA run on the CM-2 and CM-5 in data-parallel mode is written in CM Fortran; the message-passing version is written in Fortran 77. The scaled speedup results thus show the performance that can be achieved for complex and realistic applications when they are first implemented on parallel computers. Separate measurements of communication and computation time on the nCUBE 2, the iPSC/8 60, the DELTA, and the CM-5 (message-passing mode) reveal whether these machines are limited by the speed of the communication network or the processor speed.

2478 (SAND–92-1460) **An improved spectral graph partitioning algorithm for mapping parallel computations.** Hendrickson, B.; Leland, R. Sandia National Labs., Albuquerque, NM (United States). Sep 1992. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93002593. Source: OSTI; NTIS; GPO Dep.

Efficient use of a distributed memory parallel computer requires that the computational load be balanced across processors in a way that minimizes interprocessor communication. We present a new domain mapping algorithm that extends recent work in which ideas from spectral graph theory have been applied to this problem. Our generalization of spectral graph bisection involves a novel use of multiple eigenvectors to allow for division of a computation into four or eight parts at each stage of a recursive decomposition. The resulting method is suitable for scientific computations like irregular finite elements or differences performed on hypercube or mesh architecture machines. Experimental results confirm that the new method provides better decompositions arrived at more economically and robustly than with previous spectral methods. We have also improved upon the known spectral lower bound for graph bisection.

2479 (SAND–92-1872C) **UNICOS® security system.** Vandevender, W.H. Sandia National Labs., Albuquerque, NM (United States). 17 Sep 1992. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-9209204–2: Cray users group meeting, Washington, DC (United States), 14-18 Sep 1992). Order Number DE92040967. Source: OSTI; NTIS; GPO Dep.

Developing security plans and supporting security tests is a very important part of the Department of Energy accreditation process. This paper will discuss the general testing methodology that was used to achieve DOE accreditation of the Secure UNICOS environment at Sandia National Laboratories, Albuquerque. In addition, some specific security testing procedures, test and problem areas will be described.

2480 (SAND–92-2040C) **UniTree, a mass storage solution at Sandia National Laboratories.** Kelly, S.M. Sandia National Labs., Albuquerque, NM (United States). [1992]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-9209204–3: Cray users group meeting, Washington, DC (United States), 14-18 Sep 1992). Order Number DE92041155. Source: OSTI; NTIS; GPO Dep.

Sandia National Laboratories has recently placed into production a mass storage system based on the UniTree™ Central File Manager software. this paper describes the current status of the system. Background information on the selection criteria is given and the hardware and software configurations are shown. The system has been in production since April, 1992 and the usage and performance statistics, as obtained thus far, are presented.

2481 (SAND–92-2057) **Design and development of an IBM/VM menu system.** Cazzola, D.J. Sandia National Labs., Albuquerque, NM (United States). Oct 1992. 59p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93002512. Source: OSTI; NTIS; GPO Dep.

This report describes a full screen menu system developed using IBM's Interactive System Productivity Facility (ISPF) and the REXX programming language. The software was developed for the 2800 IBM/VM Electrical Computer Aided Design (ECAD) system. The system was developed to deliver electronic drawing definitions to a corporate drawing release system. Although this report documents the status of the menu system when it was retired, the methodologies used and the requirements defined are very applicable to replacement systems.

2482 (SKB-TR–92-01) **GEOTAB. Overview.** Eriksson, E. (SGAB, Luleaa (Sweden)); Stark, T.; Johansson, B.; Magnusson, S.; Gerlach, M.; Sehlstedt, S.; Nilsson, A.C. Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden). Jan 1992. 37p. Order Number DE93604069. Source: OSTI; NTIS; INIS.

Since 1977 Swedish Nuclear Fuel and Waste Managements Co., SKB has been performing a research and development program for the final disposal of spent nuclear fuel. One aim of this program is to gain knowledge of different bedrock properties. Measurements for the characterization of geological, geophysical, hydrogeological and hydrochemical conditions are performed in specific site investigations as well as for geoscientific projects. Large volumes of data have been produced since the start of the program, in the form of both raw data and results. During (the course of) the research program this data has been stored in various formats by different institutions and companies performing the investigations. It was therefore decided that all data from the research and development program should be stored in a single database. The database, called Geotab, is a relational database, based on a database handling system from Mimer Information Systems. The application program, also called GEOTAB, was developed by Ergodata. This manual provides a description of the basics of the database and application programs used in connection with GEOTAB. It is intended as an introduction for new and regular users. The database is a mix of information organized so that storage, retrieval and modification of the data is as efficient as possible. GEOTAB is built around a relational database model. (au).

2483 (UCRL-ID–107022-92) **The 1992 MPCI yearly report: Harnessing the killer micros.** Brooks, E.D. III; Heston, B.J.; Warren, K.H.; Woods, L.J. (eds.). Lawrence Livermore National Lab., CA (United States). Aug 1992. 340p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE93001831. Source: OSTI; NTIS; GPO Dep.

This report contains a collection of papers on massively parallel computing and applications of this type of processing. (LSP)

2484 (UCRL-JC–110061) **Radial basis functions: A class of grid-free, scattered data approximations.** Kansa, E.J.; Carlson, R.E. Lawrence Livermore National Lab., CA (United States). 20 Mar 1992. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-921209–1: International Association Mathematics and Computers Simulation (IAMCS) international symposium on mathematical modelling and computer simulation, Bangalore (India), 7-11 Dec 1992). Order Number DE92012675. Source: OSTI; NTIS; GPO Dep.

Recent developments in the theory and applications of radial basis functions are summarized. One intriguing property of such approximation methods is that rates of convergence improve with increasing dimensions. Also, such approximations, under favorable circumstances, can have exponential convergence. Numerical applications, especially on sparse scattered data sets of high dimensions, validate these theoretical claims.

2485 (UCRL-JC–110450) **Preconditioned time-difference methods for solving advective-diffusive systems.** Rodrigue, G.; Wolitzer, D. Lawrence Livermore National Lab., CA (United States). Apr 1992. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-921209–2: International Association Mathematics and Computers Simulation (IAMCS) international symposium on mathematical modelling and computer simulation, Bangalore (India), 7-11 Dec 1992). Order Number DE92014790. Source: OSTI; NTIS; GPO Dep.

Explicit time differencing methods for solving differential equations are advantageous in that they are easy to implement on a computer and are intrinsically very parallel. The disadvantage of explicit methods is the severe restrictions that are placed on stable time-step intervals. Stability bounds for explicit time differencing methods on advective-diffusive problems are generally determined by the diffusive part of the problem. These bounds are very small and implicit methods are used instead. The linear systems arising from these implicit methods are generally solved by iterative methods. In this paper we develop a methodology for increasing the stability bounds of standard explicit finite differencing methods by combining explicit methods, implicit methods, and iterative methods in a novel way to generate new time-difference schemes, called preconditioned time-difference methods. A stability analysis is performed on a particular version of this method for the diffusion equation. Several computational examples of advective-diffusive problems are solved to demonstrate the increased stability limits.

2486 (VTT-TIED–966) **Thermal hydraulic reactor safety analyses and experiments.** Holmstroem, H. (Technical Research Centre of Finland, Espoo (Finland). Nuclear Engineering Lab.); Eerikaeinen, L.; Kervinen, T.; Kilpi, K.; Mattila, L.; Miettinen, J.; Yrjoelae, V. Technical Research Centre of Finland, Espoo (Finland). Apr 1989. 148p. (In Finnish). Order Number DE93606015. Source: OSTI; NTIS; INIS.

The report introduces the results of the thermal hydraulic reactor safety research performed in the Nuclear Engineering Laboratory of the Technical Research Centre of Finland (VTT) during the years 1972-1987. Also practical applications i.e. analyses for the safety authorities and power companies are presented. The emphasis is on description of the state-of-the-art know how. The report describes VTT's most important computer codes, both those of foreign origin and those developed at VTT, and their assessment work, VTT's own experimental research, as well as international experimental projects and other forms of cooperation VTT has participated in. Appendix 8 contains a comprehensive list of the most important publications and technical reports produced. They present the content and results of the research in detail.(orig.).

9903 Information Handling

Refer also to citation(s) 127, 128, 552, 608, 786, 796, 1270, 1460, 1500, 1501

2487 (ANL/CP–76976) **How scientific must technical editors be?.** Caruthers, C.M. Argonne National Lab., IL (United States). 28 Jul 1992. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9209142–7: Institute of Electrical and Electronics Engineers (IEEE) international professional communications conference (IPCC): crossing frontiers, Santa Fe, NM (United States), 30 Sep 1992). Order Number DE92040741. Source: OSTI; NTIS; GPO Dep.

As a senior technical editor in the Computing and Telecommunications Division at Argonne National Laboratory. I am responsible for a small technical editing group including regular staff, temporary editors, and interns. I have supervised some 22 technical communications interns over the past ten years. Previously, I taught at the university level for 21 years. These experiences have led me to believe that while scientific knowledge in the technical editing process is valuable, it is not essential, but a thorough awareness of verbal structure and intended audience is essential. As I composed this paper, I found myself staring at the posted description of an editing job available in another division at Argonne, prominently requiring "thorough grounding in the basic sciences, including mathematics and physics." This popular assumption–that successful editors of scientific documents must have some expertise in the scientific field to which the documents relate–is, in my judgment, often magnified out of proportion.

2488 (DOE/ER/13815–T1) **Numerical Data Advisory Board annual report, 1988–1989.** National Research Council, Washington, DC (United States). Numerical Data Advisory Board. 1989. 28p. Sponsored by USDOE, Washington, DC (United States); National Aeronautics and Space Administration, Washington, DC (United States); National Science Foundation, Washington, DC (United States); National Inst. of Standards and Technology, Gaithersburg, MD (U DOE Contract FG05-87ER13815 ;FG05-82TC11276. Contract 50SBNB8C5167/C;Contract NASW-4102;Contract 467-MZ-90007 Order Number DE93001744. Source: OSTI; NTIS; GPO Dep.

The objective of the Numerical Data Advisory Board (NDAB) and its committees and panels is improvement in the quality, reliability, accessibility, dissemination, utilization, and management of data. NDAB seeks to promote an appreciation of the importance of evaluated data to scientists, engineers, and others who require reliable numerical data for research and for decision making. Delivery of numerical data to the research community is a newly added emphasis of NDAB's program. The Numerical Data Advisory Board is

an interdisciplinary board, with representation form physics, chemistry, engineering, statistics, biosciences, geosciences, and interdisciplinary sciences. Because the goals of NDAB and the goals of CODATA overlap in several ways, NDAB meetings are held in conjunction with meetings of the US National Committee for CODATA (USNC/CODATA), thus informally broadening the representation from each of the disciplines. Lists of members of NDAB and its committees and panels are given in Attachment A.

2489 (IAEA-NDS–7(Rev.92/7)) **Index of nuclear data libraries available from the IAEA Nuclear Data Section.** IAEA-NDS-Documentation Series. Lemmel, H.D. International Atomic Energy Agency, Vienna (Austria). INTOR Group. Jul 1992. 29p. Order Number DE93604056. Source: OSTI; NTIS (US Sales Only); INIS.

This document lists more than 80 nuclear data libraries together with references that give more detailed information about these libraries. All data and documentation references are available upon request from the IAEA Nuclear Data Section, free of charge. (author).

9904 Law

2490 (IAEA-INFCIRC–167(Add.15)) **The text of the agreement to extend the regional co-operative agreement for research, development and training related to nuclear science and technology, 1987.** International Atomic Energy Agency, Vienna (Austria). Sep 1992. 3p. Order Number DE93606003. Source: OSTI; NTIS (US Sales Only); INIS.

Hard copies are available in English, French, Russian and Spanish from IAEA Div. of Publications, Distribution Unit.

The document reproduces the text of the Agreement to Extend the Regional Co-operative Agreement for Research, Development and Training Related to Nuclear Science and Technology, 1987, for a further period of five years with effect from 12 June 1992. Australia, Bangladesh, the People's Republic of China, India, Indonesia, Japan, the Republic of Korea, Malaysia, Pakistan, the Philippines, Singapore, Sri Lanka, Thailand and Viet Nam are parties of this Agreement.

2491 (IAEA-INFCIRC–335(Add.6)) **Convention on early notification of a nuclear accident and convention on assistance in the case of a nuclear accident or radiological emergency.** International Atomic Energy Agency, Vienna (Austria). Sep 1992. 41p. (IAEA-INFCIRC–336(Add.7).). Order Number DE93606004. Source: OSTI; NTIS (US Sales Only); INIS.

Hard copies are available in English, French, Russian and Spanish from IAEA Div. of Publications, Distribution Unit.

The document refers to the Convention on Early Notification of a Nuclear Accident (CENNA) (IAEA-INFCIRC-335) and the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency (CANARE) (IAEA-INFCIRC-336). Part I contains the status lists as of 10 September 1992, part II contains the texts of reservations/declarations made upon expressing consent to be bound and objections there to, and part III contains the texts of reservations/declarations made upon signature.

2492 (INIS-mf–13367) **Code on the safety of nuclear power plants: Siting.** Bezpecnost Jadernych Zarizeni. Ceskoslovenska Komise pro Atomovou Energii, Prague (Czechoslovakia). 1992 19p. Translation of IAEA publication (Safety Series No. 50-C-S (Rev. 1)). International Atomic Energy Agency, Vienna 1988. (In Czech). Order Number DE93606005. Source: OSTI; NTIS (US Sales Only); INIS.

This Code provides criteria and procedures that are recommended for safety in nuclear power plant siting. It forms part of the Agency's programme for establishing Codes and Safety Guides relating to land based stationary thermal neutron power plants.

2493 (KAERI/RR–1083/91) **A study on general improvements of the atomic energy law system.** Ham, Chol Hoon (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Kim, Sang Won. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Feb 1992. 108p. (In Korean). Order Number DE93605964. Source: OSTI; NTIS (US Sales Only); INIS.

This study contains the ethical aspects on nuclear wastes management, the responsibilities in radwastes management, the disposal of low and intermediate level radioactive wastes, the cost of nuclear wastes management and Korean regulatory system of nuclear wastes. The successful development of national nuclear projects depends on the establishment of safe management of wastes. The improvements of safety and regulatory systems on the radwastes as well as amendments of existing law is essential. For the purpose of reference, we appended translated Japanese law. (Author).

Corporate Author Index

This index lists the corporate authors responsible for issuing the documents in this publication which are identified primarily by report number. The corporate names are entered in standardized forms as defined in ETDE/PUB–3, *International Energy: Research Organizations 1986–1990*. Each entry under a corporate name includes the document title and citation number. Three items of information may appear in parentheses: (1) an abbreviation to identify the document type, such as a report; (2) the country of publication, indicated by International Organization for Standardization (ISO) country code; and (3) the language of the document if non-English (R;CA;In French). Author affiliations are not listed in this index.

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	Pacific Northwest Lab., Richland, WA (United States)	
	18:253	PNL–8047
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	18:258	PNL-SA–21009
	18:259	PNL-SA–21233
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	18:1221	PNL-SA-20751
	18:1502	PNL-SA-20951
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	18:1582	PNL-8143
	18:1728	BNWL-CC-250
	18:1759	PNL-7877-Rev.1
	18:2444	ESTSC-000525IBMPC00
	American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., Atlanta, GA (United States)	
	18:1729	CONF-910529-
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	USDOE Bonneville Power Administration, Portland, OR (United States). Div. of Fish and Wildlife	
	18:1628	DOE/BP-01830-12
	Du Pont de Nemours (E.I.) and Co., Richland, WA (United States)	
	18:628	HW-7-3486
	Pacific Northwest Lab., Richland, WA (United States). Environmental Management Operations	
	18:1564	EMO-1028-Vol.8
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	Hanford Atomic Products Operation, Richland, WA (United States)	
	18:710	HW-33999
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AC06-83ER40128	**Brookhaven National Lab., Upton, NY (United States)**	
	18:1347	BNL-47827
AC06-87RL10930	**Westinghouse Hanford Co., Richland, WA (United States)**	
	18:273	WHC-EP-0474-5
	18:274	WHC-EP-0524
	USDOE Richland Field Office, WA (United States)	
	18:229	DOE/RL-90-48
AC07-76ID01570	**Argonne National Lab., IL (United States)**	
	18:1029	ANL/CP-77169
	EG and G Idaho, Inc., Idaho Falls, ID (United States)	
	18:708	EGG-TMI-7757
	Sandia National Labs., Albuquerque, NM (United States)	
	18:1020	SAND-92-1289C
	California Univ., Los Angeles, CA (United States). Inst. of Plasma and Fusion Research	
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	18:584	NUREG/CR-5416
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	USDOE Assistant Secretary for Conservation and Renewable Energy, Washington, DC (United States). Geothermal Div.	
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	18:400	CONF-920378-
AC07-84ID12435	**Westinghouse Idaho Nuclear Co., Inc., Idaho Falls, ID (United States)**	
	18:275	WINCO-11876
AC08-85NV10384	**USDOE Nevada Operations Office, Las Vegas, NV (United States)**	
	18:227	DOE/NV/10384-13
AC08-88NV10617	**EG and G Energy Measurements, Inc., Los Alamos, NM (United States). Los Alamos Operations**	
	18:1356	EGG-10617-5116
	18:1404	EGG-10617-5100
	EG and G Energy Measurements, Inc., Las Vegas, NV (United States)	
	18:1492	EGG-10617-1151
	EG and G Energy Measurements, Inc., Goleta, CA (United States). Santa Barbara Operations	
	18:734	EGG-10617-2129
	EG and G Energy Measurements, Inc., Pleasanton, CA (United States). Amador Valley Operations	
	18:1403	EGG-10617-4104
	EG and G Energy Measurements, Inc., Santa Barbara, CA (United States). Special Technologies Lab.	
	18:312	EGG-10617-3012
AC08-89NV10630	**Reynolds Electrical and Engineering Co., Inc., Las Vegas, NV (United States)**	
	18:1489	DOE/NV/10630-33-Vol.1
	18:1490	DOE/NV/10630-33-Vol.2
AC08-90NV10845	**Nevada Univ., Reno, NV (United States). Water Resources Center**	
	18:295	DOE/NV/10845-14
AC09-76SR00001	**Du Pont de Nemours (E.I.) and Co., Aiken, SC (United States)**	
	18:502	DPW-871
	18:617	DPSP-61-1841
	18:618	DPSP-61-2291
	Du Pont de Nemours (E.I.) and Co., Aiken, SC (United States). Savannah River Plant	
	18:620	DPSP-75-1219
	Du Pont de Nemours (E.I.) and Co., Wilmington, DE (United States)	
	18:171	DPW-5915
	18:585	DPW-5423
	18:1206	DPW-5411
	Du Pont de Nemours (E.I.) and Co., Wilmington, DE (United States). Explosives Dept.	
	18:165	DPW-5570
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	18:1207	DPW–5520
	Du Pont de Nemours (E.I.) and Co., Wilmington, DE (United States). Technical Div.	
	18:595	DPW–5110
AC09-89SR18035	**Du Pont de Nemours (E.I.) and Co., Aiken, SC (United States)**	
	18:502	DPW–871
	18:616	DPSP–58-814
	18:617	DPSP–61-1841
	18:618	DPSP–61-2291
	18:619	DPSP–64-2079
	Du Pont de Nemours (E.I.) and Co., Aiken, SC (United States). Savannah River Lab.	
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	Du Pont de Nemours (E.I.) and Co., Aiken, SC (United States). Savannah River Plant	
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	Westinghouse Savannah River Co., Aiken, SC (United States)	
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	18:278	WSRC-RP–90-1055-Rev.1
	18:279	WSRC-TR–91-648
	18:280	WSRC-TR–92-260
	18:301	WSRC-MS–92-278
	18:704	WSRC-RP–91-0952
	18:1179	WSRC-MS–92-332
	18:1259	WSRC-MS–91-416
	18:1536	WSRC-MS–92-211
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	18:1761	WSRC-MS–92-212
	18:1773	WSRC-RP–92-240
AC21-82MC24223	**Westinghouse Electric Corp., Pittsburgh, PA (United States). Nuclear and Advanced Technology Div.**	
	18:825	DOE/MC/24223–3103
AC21-85MC22194	**Ceramatec, Inc., Salt Lake City, UT (United States)**	
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AC21-87MC11089	**Institute of Gas Technology, Chicago, IL (United States)**	
	18:150	DOE/MC/11089–3094-Vol.3
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AC21-87MC23270	**International Fuel Cells Corp., South Windsor, CT (United States)**	
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AC21-87MC24216	**Donlee Technologies, Inc., York, PA (United States)**	
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AC21-88MC24120	**CER Corp., Las Vegas, NV (United States)**	
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AC21-88MC25009	**Energy Research Corp., Danbury, CT (United States)**	
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AC21-88MC25020	**Lummus Crest, Inc., Bloomfield, NJ (United States)**	
	18:23	DOE/MC/25020–3129
AC21-88MC25026	**Institute of Gas Technology, Chicago, IL (United States)**	
	18:827	DOE/MC/25026–3106
AC21-89MC26233	**Battelle, Columbus, OH (United States)**	
	18:24	DOE/MC/26233–2935
AC21-89MC26366	**Louisiana State Univ., Baton Rouge, LA (United States). Dept. of Chemical Engineering**	
	18:25	DOE/MC/26366–2979
AC21-90MC26024	**CER Corp., Las Vegas, NV (United States)**	
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AC21-90MC27394	**M-C Power Corp., Burr Ridge, IL (United States)**	
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AC21-91MC27260	**Hillin-Simon Oil Co., Midland, TX (United States)**	
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AC21-91MC28239	**PrimeEnergy Corp., Stamford, CT (United States)**	
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AC22-85PC81004	**UOP, Inc., Des Plaines, IL (United States)**	
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AC22-86PC90751	**PSI Technology Co., Andover, MA (United States)**	
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AC22-87PC79672	**TRW Space and Technology Group, Redondo Beach, CA (United States). Applied Technology Div.**	
	18:820	DOE/PC/79672–T3
AC22-87PC79892	**Virginia Center for Coal and Minerals Processing, Blacksburg, VA (United States)**	
	18:2	DOE/PC/79892–T21
AC22-87PC79901	**Advanced Fuel Research, Inc., East Hartford, CT (United States)**	
	18:55	DOE/PC/79901–T5
	18:56	DOE/PC/79901–T7
AC22-87PC79903	**Stanford Univ., CA (United States). High Temperature Gasdynamics Lab.**	
	18:57	DOE/PC/79903–T15
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AC22-87PC90274	**TRW Space and Technology Group, Redondo Beach, CA (United States). Applied Technology Div.**	
	18:821	DOE/PC/90274–T19
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AC22-88ID12735	**MSE, Inc., Butte, MT (United States)**	
	18:819	DOE/ID/12735–T24
AC22-89PC89757	**Lehigh Univ., Bethlehem, PA (United States). Dept. of Chemistry**	
	18:59	DOE/PC/89757–9
AC22-89PC89869	**UOP, Inc., Des Plaines, IL (United States)**	
	18:26	DOE/PC/89869–T7
	18:27	DOE/PC/89869–T8
AC22-89PC89878	**Advanced Fuel Research, Inc., East Hartford, CT (United States)**	
	18:21	CONF-920815–9
AC22-89PC89883	**Consolidation Coal Co., Library, PA (United States). Research and Development Dept.**	
	18:28	DOE/PC/89883–45
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AC22-90BC14664	**Michigan Univ., Ann Arbor, MI (United States)**	
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AC22-90PC90055	**UOP, Inc., Des Plaines, IL (United States)**	
	18:30	DOE/PC/90055–T5
AC22-90PC90174	**Virginia Center for Coal and Minerals Processing, Blacksburg, VA (United States)**	
	18:4	DOE/PC/90174–T5
AC22-90PC90361	**North Dakota Univ., Grand Forks, ND (United States). Energy and Environmental Research Center**	
	18:431	DOE/PC/90361–T7

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AC22-91PC90365	Southern Research Inst., Birmingham, AL (United States)	
	18:432	DOE/PC/90365–T7
AC22-91PC91040	Kentucky Univ., Lexington, KY (United States). Center for Applied Energy Research	
	18:33	DOE/PC/91040–T3
AC22-91PC91041	BCR National Lab., Pittsburgh, PA (United States)	
	18:34	DOE/PC/91041–T1
	18:35	DOE/PC/91041–T2
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AC22-91PC91043	Western Research Inst., Laramie, WY (United States)	
	18:37	DOE/PC/91043–T3
AC22-91PC91053	SRI International, Menlo Park, CA (United States). Chemistry Lab.	
	18:53	SRI–2847-9
AC22-91PC91058	Kentucky Univ., Lexington, KY (United States). Center for Applied Energy Research	
	18:38	DOE/PC/91058–T1
	18:39	DOE/PC/91058–T2
AC22-91PC91154	Foster Wheeler Development Corp., Livingston, NJ (United States)	
	18:425	DOE/PC/91154–T2
AC22-91PC91161	Vortec Corp., Collegeville, PA (United States)	
	18:87	DOE/PC/91161–T1
AC22-92PC91344	SRI International, Menlo Park, CA (United States)	
	18:436	DOE/PC/91344–T1
AC34-90DP62349	EG and G Rocky Flats, Inc., Golden, CO (United States)	
	18:1642	RFP–4553
	EG and G Rocky Flats, Inc., Golden, CO (United States). Rocky Flats Plant	
	18:260	RFP–4485
AC35-89ER40486	Superconducting Super Collider Lab., Dallas, TX (United States)	
	18:1301	SSCL–582
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	18:1388	SSCL–596
	18:1389	SSCL-Preprint–134-Rev.A
	18:1390	SSCL-Preprint–140
AC79-82BP31302	Wisconsin Univ., Madison, WI (United States)	
	18:841	DOE/BP–1914
AI01-89CE50274	Little (Arthur D.), Inc., Cambridge, MA (United States)	
	18:842	DOE/CE/50274–T1
AI05-83OR21322	Oak Ridge National Lab., TN (United States)	
	18:943	ORNL/Sub–83-21322/02
AI05-90ER14161	National Inst. of Standards and Technology, Gaithersburg, MD (United States). Molecular Physics Div.	
	18:1157	DOE/ER/14161–2
	18:2074	DOE/ER/14161–1
AI05-91ER61223	Naval Postgraduate School, Monterey, CA (United States)	
	18:1632	DOE/ER/61223–1
AI05-91ER61224	Naval Postgraduate School, Monterey, CA (United States)	
	18:1633	DOE/ER/61224–1
AI79-86BP63401	Lawrence Berkeley Lab., CA (United States)	
	18:845	LBL–29752
AI79-88BP50301	National Marine Fisheries Service, Seattle, WA (United States). Coastal Zone and Estuarine Studies Div.	
	18:1629	DOE/BP/50301–3
AI79-90BP07096	Fish and Wildlife Service, Portland, OR (United States). Columbia River Field Station	
	18:1553	DOE/BP/07096–2
AM06-70RL02225	American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., Atlanta, GA (United States)	
	18:1729	CONF-910529–
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AS04-86AL33209	Princeton Univ., NJ (United States). Dept. of Mechanical and Aerospace Engineering	
	18:940	DOE/AL/33209–T1
AS05-76ER03346	Oak Ridge National Lab., TN (United States)	
	18:2016	CONF-920721–13
AS05-76ER04936	Tennessee Univ., Knoxville, TN (United States)	
	18:1991	CONF-860158–9
AS05-81ER40032	Brookhaven National Lab., Upton, NY (United States)	
	18:1343	BNL–46833-Rev.
AT06-82ER13032	Rensselaer Polytechnic Inst., Troy, NY (United States). Dept. of Nuclear Engineering and Engineering Physics	
	18:1235	DOE/ER/13032–T2
BI79-90BP12885	Idaho Univ., Moscow, ID (United States)	
	18:1669	DOE/BP/12885–1
FC02-86CH10250	Flow Research Co., Kent, WA (United States). Applied Mechanics Div.	
	18:414	DOE/CH/10250–T1
FC02-86CH10253	Altamont Energy Corp., Corte Madera, CA (United States)	
	18:415	DOE/CH/10253–T1
FC02-91ER61230	Johns Hopkins Univ., Baltimore, MD (United States)	
	18:1673	DOE/ER/61230–1
FC07-85NV10412	Texas Univ., Austin, TX (United States)	
	18:105	DOE/NV/10412–3
FC07-85NV10425	Louisiana Geological Survey, Baton Rouge, LA (United States)	
	18:399	DOE/NV/10425–T12
FC07-90ID12949	ELTECH Research Corp., Fairport Harbor, OH (United States)	
	18:1040	DOE/ID/12949–T1
FC21-87MC24207	West Virginia Univ., Morgantown, WV (United States). Dept. of Chemistry	
	18:22	DOE/MC/24207–2994
	West Virginia Univ., Morgantown, WV (United States). Dept. of Chemical Engineering	
	18:82	DOE/MC/24207–2996
	West Virginia Univ., Morgantown, WV (United States). Dept. of Mathematics	
	18:2420	DOE/MC/24207–2995
FC22-83FE60149	National Inst. for Petroleum and Energy Research, Bartlesville, OK (United States)	
	18:110	NIPER–613
	18:2472	NIPER–596
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FC22-90PC89652	Southern Co. Services, Inc., Birmingham, AL (United States)	
	18:429	DOE/PC/89652–T7
FG01-87CE15307	Missouri Univ., Rolla, MO (United States). High Pressure Waterjet Lab.	
	18:76	DOE/CE/15307–T1

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FG01-89CE28309	Synergic Resources Corp., Bala-Cynwyd, PA (United States)	
	18:800	SRC–7523-R6
FG01-90CE15482	Buckman (William G.), Bowling Green, KY (United States)	
	18:101	DOE/CE/15482–T8
FG01-91CE15497	Nu-Bore Systems, Wichita Falls, TX (United States)	
	18:102	DOE/CE/15497–T2
FG01-91CE26616	District Energy Corp. of Lincoln and Lancaster County, NE (United States)	
	18:899	DOE/CE/26616–T1
FG01-92CE15553	S-Cal Research Corp., San Rafael, CA (United States)	
	18:103	DOE/CE/15553–T1
FG02-84CH10204	Morehouse Coll., Atlanta, GA (United States)	
	18:1092	DOE/CH/10204–T1
FG02-84CH10205	Arizona Univ., Tucson, AZ (United States)	
	18:381	DOE/CH/10205–T5
	18:382	DOE/CH/10205–T6
	Arizona Univ., Tucson, AZ (United States). Environmental Research Lab.	
	18:379	DOE/CH/10205–T2
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FG02-84ER13227	Utah Univ., Salt Lake City, UT (United States)	
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FG02-84ER13290	Delaware Univ., Newark, DE (United States)	
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FG02-84ER40153	Cincinnati Univ., OH (United States)	
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FG02-84ER45097	Purdue Univ., Lafayette, IN (United States)	
	18:1355	DOE/ER/45183–8
FG02-84ER60253	Kansas State Univ., Manhattan, KS (United States). Dept. of Agronomy	
	18:1558	DOE/ER/60253–T5
FG02-85CE40738	Sandia National Labs., Albuquerque, NM (United States)	
	18:895	SAND–92-1290C
FG02-85ER13335	Massachusetts Inst. of Tech., Cambridge, MA (United States)	
	18:2202	DOE/ER/13335–1
FG02-85ER13404	Minnesota Univ., Minneapolis, MN (United States). Dept. of Chemistry	
	18:1186	DOE/ER/13404–7
FG02-85ER13433	Minnesota Univ., Minneapolis, MN (United States). Dept. of Mechanical Engineering	
	18:1093	DOE/ER/13433–4
FG02-85ER45183	Purdue Univ., Lafayette, IN (United States)	
	18:1355	DOE/ER/45183–8
FG02-85ER45184	Michigan Univ., Ann Arbor, MI (United States). Dept. of Nuclear Engineering	
	18:972	DOE/ER/45184–T1
FG02-85ER52118	California Univ., Los Angeles, CA (United States). Inst. of Plasma and Fusion Research	
	18:2391	UCLA-PPG–1323-Vol.2
FG02-85ER53198	Wisconsin Univ., Madison, WI (United States)	
	18:2312	DOE/ER/53198–199
	Wisconsin Univ., Madison, WI (United States). Dept. of Physics	
	18:2361	DOE/ER/53198–205
FG02-85ER60294	Pennsylvania State Univ., University Park, PA (United States). Dept. of Meteorology	
	18:1481	DOE/ER/60294–T2
	18:1482	DOE/ER/60294–T3
FG02-85ER60304	Brown Univ., Providence, RI (United States)	
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FG02-86ER13463	Brigham Young Univ., Provo, UT (United States). Dept. of Chemistry	
	18:1153	DOE/ER/13463–9
FG02-86ER13491	Kansas State Univ., Manhattan, KS (United States). J.R. MacDonald Lab.	
	18:2086	DOE/ER/13491–577
FG02-86ER13603	Boston Univ., MA (United States). Dept. of Chemistry	
	18:1184	DOE/ER/13603–6
FG02-86ER40269	Colorado Univ., Boulder, CO (United States). Nuclear Physics Lab.	
	18:2028	DOE/ER/40269–14
FG02-86ER45229	Northwestern Univ., Evanston, IL (United States). Dept. of Materials Science and Engineering	
	18:973	DOE/ER/45229–27
FG02-86ER45253	Colorado School of Mines, Golden, CO (United States). Dept. of Physics	
	18:974	DOE/ER/45253–7
FG02-86ER53218	Wisconsin Univ., Madison, WI (United States). Dept. of Nuclear Engineering and Engineering Physics	
	18:2393	UW-CPTC–92-4
FG02-86ER60407	American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., Atlanta, GA (United States)	
	18:1677	CONF-910529–
FG02-86ER60422	Atmospheric and Environmental Research, Inc., Cambridge, MA (United States)	
	18:1484	DOE/ER/60422–7
FG02-87ER13764	Wisconsin Univ., Milwaukee, WI (United States). Dept. of Mechanical Engineering	
	18:1236	DOE/ER/13764–T3
FG02-87ER40316	Washington Univ., St. Louis, MO (United States)	
	18:2029	DOE/ER/40316–6
FG02-87ER40335	Colorado Univ., Boulder, CO (United States). Nuclear Physics Lab.	
	18:2028	DOE/ER/40269–14
FG02-87ER45308	Colorado School of Mines, Golden, CO (United States). Center for Welding and Joining Research	
	18:975	DOE/ER/45308–6
FG02-87ER45314	Northwestern Univ., Evanston, IL (United States). Dept. of Materials Science and Engineering	
	18:1094	DOE/ER/45314–5
FG02-87ER60561	Michigan Univ., Ann Arbor, MI (United States)	
	18:1679	DOE/ER/60561–7
FG02-87ER60612	Colorado State Univ., Fort Collins, CO (United States). Dept. of Range Science	
	18:1559	DOE/ER/60612–4
FG02-88ER13878	Minnesota Univ., Minneapolis, MN (United States)	
	18:1200	DOE/ER/13878–4
FG02-88ER40389	Temple Univ., Philadelphia, PA (United States). Dept. of Physics	
	18:1927	DOE/ER/40389–75
FG02-88ER40408	Purdue Univ., Lafayette, IN (United States). Dept. of Chemistry	
	18:2030	DOE/ER/40408–7
FG02-88ER40417	Clark Univ., Worcester, MA (United States)	
	18:1994	DOE/ER/40417–9

Contract No.	Abstract No.	Report No.
FG02-88ER45372	Northwestern Univ., Evanston, IL (United States). Dept. of Physics and Astronomy	
	18:1038	DOE/ER/45372–5
FG02-88ER60636	Johns Hopkins Univ., Baltimore, MD (United States)	
	18:1671	DOE/ER/60636–4
FG02-88ER60674	New York Univ., NY (United States). Dept. of Chemistry	
	18:1763	DOE/ER/60674–5
FG02-88ER60700	Utah Univ., Salt Lake City, UT (United States)	
	18:1666	DOE/ER/60700–5
FG02-88ER60715	Colorado State Univ., Fort Collins, CO (United States). Dept. of Biology	
	18:1560	DOE/ER/60715–3
FG02-88ER60742	Vermont Univ., Burlington, VT (United States). Dept. of Microbiology and Molecular Genetics	
	18:1733	DOE/ER/60742–5
FG02-89ER14011	Johns Hopkins Univ., Baltimore, MD (United States)	
	18:328	DOE/ER/14011–2
FG02-89ER14079	Colorado School of Mines, Golden, CO (United States). Center for Wave Phenomena	
	18:1775	DOE/ER/14079–19
	18:1776	DOE/ER/14079–20
FG02-89ER14080	Delaware Univ., Newark, DE (United States). Dept. of Chemistry and Biochemistry	
	18:1156	DOE/ER/14080–3
FG02-89ER51124	Grumman Corp., Princeton, NJ (United States)	
	18:2311	DOE/ER/51124–7
FG02-89ER53291	Oak Ridge National Lab., TN (United States)	
	18:2305	CONF-920142–2
FG02-89ER53296	Wisconsin Univ., Madison, WI (United States). Dept. of Nuclear Engineering and Engineering Physics	
	18:2318	DOE/ER/53296–3
FG02-90ER12933	California Univ., Santa Barbara, CA (United States). Dept. of Chemical and Nuclear Engineering	
	18:1234	DOE/ER/12933–3
FG02-90ER13030	Illinois Univ., Urbana, IL (United States). Dept. of Nuclear Engineering	
	18:555	DOE/ER/13030–2
FG02-90ER13045	Purdue Univ., Lafayette, IN (United States). Thermalhydraulics and Reactor Safety Lab.	
	18:501	DOE/ER/13045–T1
FG02-90ER14139	USDOE Pittsburgh Energy Technology Center, PA (United States)	
	18:80	CONF-9110369–
FG02-90ER14153	Yale Univ., New Haven, CT (United States)	
	18:1777	DOE/ER/14153–2
FG02-90ER45414	Pennsylvania State Univ., University Park, PA (United States). Dept. of Materials Science and Engineering	
	18:977	DOE/ER/45414–T1
FG02-90ER45419	Lehigh Univ., Bethlehem, PA (United States)	
	18:1095	DOE/ER/45419–3
FG02-90ER60946	Johns Hopkins Univ., Baltimore, MD (United States). Dept. of Geography and Environmental Engineering	
	18:1631	DOE/ER/60946–3
FG02-90ER61057	Wisconsin Univ., Madison, WI (United States). Space Science and Engineering Center	
	18:1485	DOE/ER/61057–2
FG02-90ER61059	Utah Univ., Salt Lake City, UT (United States). Dept. of Meteorology	
	18:1486	DOE/ER/61059–1
FG02-90ER61065	Atmospheric and Environmental Research, Inc., Cambridge, MA (United States)	
	18:1487	DOE/ER/61065–2
FG02-91CE23810	Akron Univ., OH (United States). Inst. of Polymer Science	
	18:1090	DOE/CE/23810–3E
	Trane Co., La Crosse, WI (United States)	
	18:1089	DOE/CE/23810–3D
	Iowa State Univ. of Science and Technology, Ames, IA (United States). Dept. of Mechanical Engineering	
	18:1088	DOE/CE/23810–3C
	National Inst. of Standards and Technology (IMSE), Gaithersburg, MD (United States)	
	18:1151	DOE/CE/23810–3A
	Imagination Resources, Inc., Dublin, OH (United States)	
	18:1091	DOE/CE/23810–3F
	Spauschus Associates, Inc., Atlanta, GA (United States)	
	18:1087	DOE/CE/23810–3B
FG02-91ER40606	Chicago Univ., IL (United States). Dept. of Astronomy and Astrophysics	
	18:1817	DOE/ER/40606–2
FG02-91ER40648	Lawrence Berkeley Lab., CA (United States)	
	18:1328	LBL–32580
FG02-91ER40661	Indiana Univ., Bloomington, IN (United States). Dept. of Physics	
	18:1838	DOE/ER/40661–1
FG02-91ER40669	Columbia Univ., New York, NY (United States)	
	18:1295	DOE/ER/40669–2
FG02-91ER40673	Fairfield Univ., CT (United States). Dept. of Physics	
	18:1455	DOE/ER/40673–1
FG02-91ER40682	Carnegie-Mellon Univ., Pittsburgh, PA (United States). Dept. of Physics	
	18:1818	DOE/ER/40682–18
	18:1846	DOE/ER/40682–2
	18:1847	DOE/ER/40682–4
	18:1848	DOE/ER/40682–11
	18:1849	DOE/ER/40682–12
	18:1900	DOE/ER/40682–13
	18:1929	DOE/ER/40682–6
	18:1930	DOE/ER/40682–7
FG02-91ER45445	Rhode Island Univ., Kingston, RI (United States)	
	18:2101	DOE/ER/45445–4
FG02-91ER54110	California Univ., Los Angeles, CA (United States). Inst. of Plasma and Fusion Research	
	18:2391	UCLA-PPG–1323-Vol.2
FG02-91ER61136	Rhode Island Hospital, Providence, RI (United States)	
	18:1735	DOE/ER/61136–2
FG02-91ER61162	Eleanor Roosevelt Inst., Denver, CO (United States)	
	18:1672	DOE/ER/61162–1
FG02-91ER75650	City Colleges of Chicago Harry S. Truman Coll., IL (United States)	
	18:743	DOE/ER/75650–1

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FG02-91ER75658	Alabama Univ., Birmingham, AL (United States)	
	18:744	DOE/ER/75658–1
FG02-91ER75660	University of Southern Mississippi, Hattiesburg, MS (United States)	
	18:745	DOE/ER/75660–1
FG02-91ER75663	South Carolina Univ., Columbia, SC (United States)	
	18:746	DOE/ER/75663–1
FG02-91ER75681	Montana Univ., Missoula, MT (United States)	
	18:747	DOE/ER/75681–1
FG02-91ER75682	Kansas State Univ., Manhattan, KS (United States)	
	18:748	DOE/ER/75682–1-Pt.4
	18:774	DOE/ER/75682–1
FG02-92ER40698	Brookhaven National Lab., Upton, NY (United States)	
	18:1925	BNL–47885
	City Coll., New York, NY (United States). Dept. of Physics	
	18:1901	DOE/ER/40698–1
FG02-92ER61361	Wisconsin Univ., Madison, WI (United States). Dept. of Atmospheric and Oceanic Sciences	
	18:1488	DOE/ER/61361–1
FG03-86ER13498	California Univ., Los Angeles, CA (United States). Dept. of Microbiology	
	18:327	DOE/ER/13498–T3
FG03-86ER52126	California Univ., Los Angeles, CA (United States). Inst. of Plasma and Fusion Research	
	18:2391	UCLA-PPG–1323-Vol.2
FG03-86ER53225	California Univ., Los Angeles, CA (United States). Dept. of Physics	
	18:2313	DOE/ER/53225–2
	18:2314	DOE/ER/53225–T4
	18:2316	DOE/ER/53225–T8
	California Univ., Los Angeles, CA (United States). School of Engineering and Applied Science	
	18:2315	DOE/ER/53225–T7
FG03-86SF16345	Arizona State Univ., Tempe, AZ (United States)	
	18:384	DOE/SF/16345–5
FG03-88ER45346	University of Southern California, Los Angeles, CA (United States). Dept. of Materials Science and Engineering	
	18:976	DOE/ER/45346–T1
FG03-88ER53275	California Univ., San Diego, La Jolla, CA (United States). Dept. of Physics	
	18:2317	DOE/ER/53275–4
FG03-88ER60673	California Univ., Davis, CA (United States)	
	18:1665	DOE/ER/60673–T5
FG03-89ER45400	Rockwell International Corp., Thousand Oaks, CA (United States). Science Center	
	18:1039	DOE/ER/45400–T4
FG03-90ER40546	California Univ., San Diego, La Jolla, CA (United States)	
	18:1837	DOE/ER/40546–1
	18:1899	DOE/ER/40546–T2
	California Univ., San Diego, CA (United States)	
	18:1957	DOE/ER/40546–T1
FG03-90ER40571	California Univ., Berkeley, CA (United States)	
	18:2031	DOE/ER/40571–T1
FG03-90ER54079	Texas Univ., Austin, TX (United States). Inst. for Fusion Studies	
	18:2324	DOE/ET/53088–568
FG03-91ER40662	California Univ., Los Angeles, CA (United States). Dept. of Physics	
	18:1928	DOE/ER/40662–1
FG05-80ET53088	Texas Univ., Austin, TX (United States). Inst. for Fusion Studies	
	18:2320	DOE/ET/53088–563
	18:2321	DOE/ET/53088–564
	18:2322	DOE/ET/53088–566
	18:2323	DOE/ET/53088–567
	18:2324	DOE/ET/53088–568
	18:2325	DOE/ET/53088–570
	18:2326	DOE/ET/53088–573
	18:2327	DOE/ET/53088–575
FG05-82TC11276	National Research Council, Washington, DC (United States). Numerical Data Advisory Board	
	18:2488	DOE/ER/13815–T1
FG05-84ER40145	Texas Univ., Austin, TX (United States). Dept. of Physics	
	18:1984	DOE/ER/40145–7
FG05-84ER40159	Oak Ridge National Lab., TN (United States)	
	18:2016	CONF-920721–13
FG05-84ER45151	Kentucky Univ., Lexington, KY (United States). Dept. of Physics and Astronomy	
	18:1158	DOE/ER/45151–T1
FG05-85ER13394	Virginia Univ., Charlottesville, VA (United States). Dept. of Physics	
	18:2085	DOE/ER/13394–T2
FG05-85ER13414	North Carolina Univ., Chapel Hill, NC (United States)	
	18:1774	DOE/ER/13414–T1
FG05-85ER40226	Carnegie-Mellon Univ., Pittsburgh, PA (United States). Dept. of Physics	
	18:1848	DOE/ER/40682–11
FG05-86ER13613	Tennessee Univ., Knoxville, TN (United States). Dept. of Chemistry	
	18:1131	DOE/ER/13613–36
FG05-86ER13626	Texas Univ., Austin, TX (United States). Dept. of Chemistry	
	18:1154	DOE/ER/13626–6
FG05-86ER13629	Texas Univ., Austin, TX (United States). Dept. of Chemistry and Biochemistry	
	18:1185	DOE/ER/13629–6
FG05-86ER40256	Texas A and M Univ., College Station, TX (United States). Cyclotron Inst.	
	18:1985	DOE/ER/40256–7
FG05-86ER60434	Tennessee Univ., Knoxville, TN (United States). Dept. of Chemistry	
	18:1678	DOE/ER/60434–7
FG05-87ER	California Univ., Los Angeles, CA (United States). Inst. of Plasma and Fusion Research	
	18:2391	UCLA-PPG–1323-Vol.2
FG05-87ER13659	George Washington Univ., Washington, DC (United States). Office of Sponsored Research	
	18:1132	DOE/ER/13659–6
FG05-87ER13739	Duke Univ., Durham, NC (United States). Dept. of Botany	
	18:322	DOE/ER/13739–1
FG05-87ER13815	National Research Council, Washington, DC (United States). Numerical Data Advisory Board	
	18:2488	DOE/ER/13815–T1
FG05-87ER40330	Oak Ridge National Lab., TN (United States)	
	18:2015	CONF-920721–11
FG05-87ER40361	Oak Ridge National Lab., TN (United States)	
	18:2015	CONF-920721–11

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	18:2016	CONF-920721--13
	Joint Inst. for Heavy Ion Research, Oak Ridge, TN (United States)	
	18:1992	CONF-9110289--5
FG05-88ER13846	**Maryland Univ., College Park, MD (United States). Dept. of Electrical Engineering**	
	18:2203	DOE/ER/13846--5
FG05-88ER13943	**Virginia Univ., Charlottesville, VA (United States). Dept. of Chemical Engineering**	
	18:1155	DOE/ER/13943--02
FG05-88ER13967	**North Carolina State Univ., Raleigh, NC (United States). Dept. of Microbiology**	
	18:1670	DOE/ER/13967--T1
FG05-88ER40407	**Oak Ridge National Lab., TN (United States)**	
	18:2015	CONF-920721--11
	18:2016	CONF-920721--13
FG05-88ER40415	**Oak Ridge National Lab., TN (United States)**	
	18:2016	CONF-920721--13
FG05-88ER40441	**Triangle Universities Nuclear Lab., Durham, NC (United States)**	
	18:1996	DOE/ER/40619--2
FG05-88ER40442	**Triangle Universities Nuclear Lab., Durham, NC (United States)**	
	18:1996	DOE/ER/40619--2
FG05-88ER60628	**Hawaii Univ., Honolulu, HI (United States). Dept. of Oceanography**	
	18:1630	DOE/ER/60628--3
FG05-88ER75419	**Texas A and M Univ., College Station, TX (United States). Texas Engineering Experiment Station**	
	18:104	DOE/ER/75419--T1
FG05-89ER45384	**Brookhaven National Lab., Upton, NY (United States)**	
	18:1180	BNL--47591
FG05-89ER45392	**Oak Ridge National Lab., TN (United States)**	
	18:967	CONF-9206202--2
FG05-89ER60842	**Virginia Univ., Charlottesville, VA (United States). Dept. of Environmental Sciences**	
	18:1561	DOE/ER/60842--T1
FG05-89ER60912	**Texas Univ., Houston, TX (United States)**	
	18:1734	DOE/ER/60912--T1
FG05-90ER45431	**Georgia Inst. of Tech., Atlanta, GA (United States). School of Physics**	
	18:2090	DOE/ER/45431--2
FG05-90ER61039	**Florida State Univ., Tallahassee, FL (United States). Dept. of Biological Science**	
	18:1562	DOE/ER/61159--2
FG05-91EH89150	**National Research Council, Washington, DC (United States). Board on Radiation Effects Research**	
	18:1732	DOE/EH/89150--1
FG05-91ER12115	**Texas Univ., Austin, TX (United States)**	
	18:941	DOE/ER/12115--2
FG05-91ER40617	**Louisiana State Univ., Baton Rouge, LA (United States)**	
	18:1845	DOE/ER/40617--134
FG05-91ER40619	**Triangle Universities Nuclear Lab., Durham, NC (United States)**	
	18:1996	DOE/ER/40619--2
FG05-91ER61104	**National Academy of Sciences, Washington, DC (United States)**	
	18:1680	DOE/ER/61104--T1
FG05-91ER61159	**Florida State Univ., Tallahassee, FL (United States). Dept. of Biological Science**	
	18:1562	DOE/ER/61159--2
FG05-91ER61232	**American Type Culture Collection, Rockville, MD (United States)**	
	18:1674	DOE/ER/61232--2
FG05-92ER54149	**Maryland Univ., College Park, MD (United States). Lab. for Plasma Research**	
	18:2319	DOE/ER/54149--1
FG06-84ER60245	**Alaska Univ., Fairbanks, AK (United States). Geophysical Inst.**	
	18:1476	DOE/ER/60245--2
	18:1477	DOE/ER/60245--3
	18:1478	DOE/ER/60245--4
	18:1479	DOE/ER/60245--5
	18:1480	DOE/ER/60245--6
	18:1556	DOE/ER/60245--T1
FG06-84ER60247	**Alaska Univ., Fairbanks, AK (United States). Water Research Center**	
	18:1557	DOE/ER/60247--T3
FG06-85ER13377	**Oregon State Univ., Corvallis, OR (United States)**	
	18:318	DOE/ER/13377--5
FG06-90ER40561	**Washington Univ., Seattle, WA (United States). Dept. of Physics**	
	18:1844	DOE/ER/40561--76
	Washington Univ., Seattle, WA (United States). Inst. for Nuclear Theory	
	18:1995	DOE/ER/40561--75
FG06-90ER45415	**Washington Univ., Seattle, WA (United States)**	
	18:2422	ESTSC--000440CY00000
	18:2423	ESTSC--000440IBMPC00
	18:2424	ESTSC--000440MNFRM00
FG06-91ER14224	**Washington Univ., Seattle, WA (United States). Dept. of Chemistry**	
	18:2164	DOE/ER/14224--1
FG07-86ER13572	**Idaho Univ., Moscow, ID (United States). Dept. of Chemical Engineering**	
	18:1129	DOE/ER/13572--1
	18:1130	DOE/ER/13572--4
	18:1201	DOE/ER/13572--3
FG07-88ER12809	**Michigan Univ., Ann Arbor, MI (United States). Dept. of Nuclear Engineering**	
	18:467	DOE/ER/12809--2
FG07-88ER12820	**Idaho State Univ., Pocatello, ID (United States). Coll. of Engineering**	
	18:1233	DOE/ER/12820--2
FG07-88ER12824	**Tennessee Univ., Knoxville, TN (United States). Dept. of Nuclear Engineering**	
	18:593	DOE/ER/12824--2
	18:594	DOE/ER/12824--3
FG07-88ER12825	**Michigan Univ., Ann Arbor, MI (United States). Dept. of Nuclear Engineering**	
	18:969	DOE/ER/12825--1
	18:970	DOE/ER/12825--2
	18:971	DOE/ER/12825--3
FG07-90ID12839	**Alaska Univ., Fairbanks, AK (United States). Petroleum Development Lab.**	
	18:98	DOE/ID/12839--8
FG07-90ID13040	**Oregon Inst. of Tech., Klamath Falls, OR (United States). Geo-Heat Center**	
	18:403	DOE/ID/13040--T11
FG21-91MC28080	**West Virginia Univ., Morgantown, WV (United States). Coll. of Engineering**	
	18:142	DOE/MC/28080--92/C0066
FG22-86PC90505	**Arizona Univ., Tucson, AZ (United States). Dept. of Chemical Engineering**	
	18:433	DOE/PC/90505--T9
FG22-89BC14403	**Texas Univ., Austin, TX (United States). Bureau of Economic Geology**	
	18:97	DOE/BC/14403--3
FG22-89BC14483	**Oklahoma Univ., Norman, OK (United States)**	
	18:127	DOE/BC/14483--16

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FG22-89PC89766		California Univ., Berkeley, CA (United States). Dept. of Materials Science and Mineral Engineering
	18:3	DOE/PC/89766–T8
FG22-89PC89769		Illinois Inst. of Tech., Chicago, IL (United States). Dept. of Chemical Engineering
	18:84	DOE/PC/89769–T12
FG22-90PC90169		BCR National Lab., Pittsburgh, PA (United States)
	18:85	DOE/PC/90169–T5
FG22-90PC90284		Alabama Univ., University, AL (United States). Dept. of Chemistry
	18:60	DOE/PC/90284–7
FG22-90PC90289		Colorado School of Mines, Golden, CO (United States). Dept. of Chemical Engineering and Petroleum Refining
	18:31	DOE/PC/90289–T6
FG22-90PC90292		Clark Atlanta Univ., GA (United States)
	18:430	DOE/PC/90292–T5
	18:1159	DOE/PC/90292–T6
FG22-90PC90305		Pittsburgh Univ., PA (United States). Dept. of Chemical and Petroleum Engineering
	18:32	DOE/PC/90305–T8
FG22-90PC90310		Texas A and M Univ., College Station, TX (United States). Dept. of Mechanical Engineering
	18:86	DOE/PC/90310–T7
FG22-91PC91283		Tuskegee Univ., AL (United States). Dept. of Chemical Engineering
	18:5	DOE/PC/91283–T2
FG22-91PC91284		Stanford Univ., CA (United States)
	18:434	DOE/PC/91284–T1
FG22-91PC91286		Clark Atlanta Univ., GA (United States). Research Center for Science and Technology
	18:40	DOE/PC/91286–T3
FG22-91PC91290		Kentucky Univ., Lexington, KY (United States). Center for Applied Energy Research
	18:6	DOE/PC/91290–T3
FG22-91PC91297		Clarkson Univ., Potsdam, NY (United States). Dept. of Mechanical and Aeronautical Engineering
	18:1239	DOE/PC/91297–4
FG22-91PC91306		Tennessee Univ., Knoxville, TN (United States). Dept. of Chemistry
	18:435	DOE/PC/91306–3
FG22-91PC91309		Virginia Polytechnic Inst. and State Univ., Blacksburg, VA (United States). Center for Advanced Ceramic Materials
	18:1041	DOE/PC/91309–T5
FG22-91PC91334		Illinois Univ., Chicago, IL (United States). Dept. of Chemistry
	18:63	DOE/PC/91334–T81
		Illinois Univ., Urbana, IL (United States)
	18:64	DOE/PC/91334–T82
	18:89	DOE/PC/91334–T78
	18:90	DOE/PC/91334–T79
		Southern Illinois Univ., Carbondale, IL (United States)
	18:8	DOE/PC/91334–T73
	18:9	DOE/PC/91334–T84
	18:62	DOE/PC/91334–T77
		Institute of Gas Technology, Chicago, IL (United States)
	18:42	DOE/PC/91334–T74
	18:43	DOE/PC/91334–T75
		Southern Illinois Univ., Carbondale, IL (United States). Dept. of Geology
	18:65	DOE/PC/91334–T83
		Illinois Dept. of Energy and Natural Resources, Springfield, IL (United States)
	18:44	DOE/PC/91334–T85
	18:45	DOE/PC/91334–T88
	18:47	DOE/PC/91334–T99
	18:48	DOE/PC/91334–T101
	18:49	DOE/PC/91334–T102
	18:66	DOE/PC/91334–T86
	18:67	DOE/PC/91334–T87
	18:68	DOE/PC/91334–T92
	18:74	DOE/PC/91334–T97
	18:93	DOE/PC/91334–T98
	18:94	DOE/PC/91334–T100
		Illinois State Geological Survey, Champaign, IL (United States)
	18:7	DOE/PC/91334–T69
	18:46	DOE/PC/91334–T95
	18:91	DOE/PC/91334–T80
	18:92	DOE/PC/91334–T96
		Southern Illinois Univ., Carbondale, IL (United States). Dept. of Mechanical Engineering and Energy Processes
	18:41	DOE/PC/91334–T71
		SS Energy Environmental International, Inc., Rockford, IL (United States)
	18:88	DOE/PC/91334–T76
FG22-92BC14853		Oklahoma Geological Survey, Norman, OK (United States)
	18:128	DOE/BC/14853–2
W-31109-ENG-38		Argonne National Lab., Idaho Falls, ID (United States)
	18:705	ANL/CP–76320
		Argonne National Lab., IL (United States)
	18:71	ANL/CP–75263
	18:72	ANL/CP–75598
	18:81	ANL/CP–76147
	18:294	ANL/CP–76005
	18:310	ANL/CP–76009
	18:368	CONF-9205243–
	18:516	ANL/CP–72040
	18:517	ANL/CP–76685
	18:615	ANL/CP–74935
	18:736	ANL/CP–77105
	18:753	ANL/RP–76696
	18:782	ANL/CP–77472
	18:787	ANL/CP–77467
	18:795	ANL/CP–77471
	18:816	ANL/CP–76058
	18:817	ANL/CP–77194
	18:831	ANL/CP–77435
	18:869	ANL/CP–76181
	18:870	ANL/CP–77116
	18:879	ANL/CP–76897
	18:951	ANL/CP–76266
	18:952	ANL/CP–76413
	18:953	ANL/CP–76999
	18:954	ANL/CP–77178
	18:955	ANL/MSD/CP–77632
	18:1028	ANL/CP–76328
	18:1029	ANL/CP–77169
	18:1030	ANL/CP–77183
	18:1031	ANL/CP–77430
	18:1032	ANL/CP–77431
	18:1033	ANL/CP–77432
	18:1034	ANL/CP–77433
	18:1147	ANL/CP–76412
	18:1182	ANL/CP–76566
	18:1199	ANL/CP–77468
	18:1232	ANL–92/12
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47857	18:1291	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92041315	MF-414
47885	18:1925	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92041312	MF-414
47890	18:1348	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000376	MF-410
47891	18:1035	OSTI; NTIS; GPO Dep.	E 1.99:	DE92041314	MF-404
47892	18:2418	OSTI; NTIS; GPO Dep.	E 1.99:	DE92041275	MF-405
47906	18:1400	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93001437	MF-414

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47909	18:1292	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000372	MF-414
47916	18:1676	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000374	MF-408
47937	18:1625	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000369	MF-408
47940	18:1664	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000370	MF-408
47941	18:1626	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000371	MF-408
47946	18:326	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93001438	MF-104
47948	18:1308	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93001432	MF-414
47949	18:306	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000377	MF-401
47968	18:1349	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93001655	MF-414
47969	18:1309	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93001656	MF-414
52341	18:832	OSTI; NTIS; GPO Dep.	E 1.99:	DE93002116	MF-350
BNL-NUREG–					
51581-Vol.10	18:612	*See* NUREG/CR–2907-Vol.10			
BNWL-CC–					
250	18:1728	OSTI; NTIS; GPO Dep.	E 1.99:	DE93001317	MF-500
BRE-CR–					
5/92.	18:226	*See* DOE-HMIP-RR–92.031			
CANADA–					
93000365	18:949	OSTI		TI93000365	
CCRP–					
10.	18:1743	*See* INFO–0377			
CCSN–					
13.	18:507	*See* INFO–0317			
16.	18:564	*See* INFO–0316			
19.	18:513	*See* INFO–0404			
CEA-CONF–					
10808	18:220	OSTI; NTIS (US Sales Only); INIS		DE93721039	
10942	18:464	OSTI; NTIS (US Sales Only); INIS		DE93721162	
10965	18:554	OSTI; NTIS (US Sales Only); INIS		DE93721208	
10966	18:777	OSTI; NTIS (US Sales Only); INIS		DE93721209	
10967	18:1443	OSTI; NTIS (US Sales Only); INIS		DE93721210	
10968	18:465	OSTI; NTIS (US Sales Only); INIS		DE93721211	
10977	18:1271	OSTI; NTIS (US Sales Only)		DE93721371	
10978	18:1189	OSTI; NTIS (US Sales Only); INIS		DE93721040	
10979	18:188	OSTI; NTIS (US Sales Only); INIS		DE93721041	
10980	18:2348	OSTI; NTIS (US Sales Only); INIS		DE93721042	
10981	18:221	OSTI; NTIS (US Sales Only); INIS		DE93721043	
10982	18:189	OSTI; NTIS (US Sales Only); INIS		DE93721044	
10983	18:213	OSTI; NTIS (US Sales Only); INIS		DE93721045	
10984	18:2198	OSTI; NTIS (US Sales Only); INIS		DE93721047	
10985	18:190	OSTI; NTIS (US Sales Only); INIS		DE93721046	
10986	18:2199	OSTI; NTIS (US Sales Only); INIS		DE93721048	
10987	18:2200	OSTI; NTIS (US Sales Only); INIS		DE93721049	
10988	18:754	OSTI; NTIS (US Sales Only); INIS		DE93721050	
10989	18:1079	OSTI; NTIS (US Sales Only); INIS		DE93720911	
10990	18:1080	OSTI; NTIS (US Sales Only); INIS		DE93720912	
10991	18:1081	OSTI; NTIS (US Sales Only); INIS		DE93720913	
10992	18:1082	OSTI; NTIS (US Sales Only); INIS		DE93720914	
10993	18:1083	OSTI; NTIS (US Sales Only); INIS		DE93720915	
10994	18:191	OSTI; NTIS (US Sales Only); INIS		DE93721103	
10995	18:192	OSTI; NTIS (US Sales Only); INIS		DE93721104	
10996	18:2098	OSTI; NTIS (US Sales Only); INIS		DE93721105	
10997	18:2099	OSTI; NTIS (US Sales Only); INIS		DE93721106	
10998	18:958	OSTI; NTIS (US Sales Only); INIS		DE93721107	
10999	18:2349	OSTI; NTIS (US Sales Only); INIS		DE93721108	
11000	18:2350	OSTI; NTIS (US Sales Only); INIS		DE93721109	
11001	18:2351	OSTI; NTIS (US Sales Only); INIS		DE93721110	
11002	18:2352	OSTI; NTIS (US Sales Only); INIS		DE93721111	
11003	18:222	OSTI; NTIS (US Sales Only); INIS		DE93721112	
11005	18:959	OSTI; NTIS (US Sales Only); INIS		DE93721679	
11022	18:1444	OSTI; NTIS (US Sales Only); INIS		DE93721142	
11023	18:1445	OSTI; NTIS (US Sales Only); INIS		DE93721143	
11024	18:1446	OSTI; NTIS (US Sales Only); INIS		DE93721144	
11025	18:1447	OSTI; NTIS (US Sales Only); INIS		DE93721145	
11026	18:1448	OSTI; NTIS (US Sales Only); INIS		DE93721146	
11027	18:223	OSTI; NTIS (US Sales Only); INIS		DE93721147	
11028	18:1084	OSTI; NTIS (US Sales Only); INIS		DE93721148	
11029	18:1260	OSTI; NTIS (US Sales Only); INIS		DE93721149	
11030	18:1261	OSTI; NTIS (US Sales Only); INIS		DE93721150	
11031	18:1262	OSTI; NTIS (US Sales Only); INIS		DE93721151	
11032	18:1813	OSTI; NTIS (US Sales Only); INIS		DE93721141	

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11035	18:960	OSTI; NTIS (US Sales Only); INIS		DE93721680	
11036	18:2100	OSTI; NTIS (US Sales Only); INIS		DE93721681	
11037	18:961	OSTI; NTIS (US Sales Only); INIS		DE93721682	
11038	18:962	OSTI; NTIS (US Sales Only); INIS		DE93721683	
11039	18:963	OSTI; NTIS (US Sales Only); INIS		DE93721684	
11040	18:964	OSTI; NTIS (US Sales Only); INIS		DE93721685	
11041	18:1350	OSTI; NTIS (US Sales Only); INIS		DE93721697	
CEA-DAPNIA-RA–					
1991	18:1835	OSTI; NTIS (US Sales Only); INIS		DE93721020	
CEA-DAPNIA-SPP–					
92-12	18:1836	OSTI; NTIS (US Sales Only); INIS		DE93720979	
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92-05	18:1293	OSTI; NTIS (US Sales Only); INIS		DE93720980	
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92-03	18:1310	OSTI; NTIS (US Sales Only); INIS		DE93720982	
92-05	18:1311	OSTI; NTIS (US Sales Only); INIS		DE93720983	
92-06	18:1312	OSTI; NTIS (US Sales Only); INIS		DE93720985	
92-07	18:1313	OSTI; NTIS (US Sales Only); INIS		DE93720984	
92-09	18:1314	OSTI; NTIS (US Sales Only); INIS		DE93720981	
CEA-LNS-Ph–					
92-17	18:1956	OSTI; NTIS (US Sales Only); INIS		DE93721699	
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2692	18:2353	OSTI; NTIS (US Sales Only); INIS		DE93721711	
CEAC-R–					
1-91	18:1036	OSTI; NTIS (US Sales Only); INIS		DE93603355	
1-92	18:1190	OSTI; NTIS (US Sales Only); INIS		DE93603199	
3-91	18:1401	OSTI; NTIS (US Sales Only); INIS		DE93603906	
CFFTP-G–					
8906	18:2354	OSTI; NTIS (US Sales Only); INIS		DE93604728	
9028	18:2355	OSTI; NTIS (US Sales Only); INIS		DE93604737	
9046	18:965	OSTI; NTIS (US Sales Only); INIS		DE93603347	
9091	18:2356	OSTI; NTIS (US Sales Only); INIS		DE93604738	
9092	18:2357	OSTI; NTIS (US Sales Only); INIS		DE93604739	
CMI-R–					
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92-06	18:1818	*See* DOE/ER/40682–18			
92-07	18:1846	*See* DOE/ER/40682–2			
92-09	18:1847	*See* DOE/ER/40682–4			
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92-16	18:1848	*See* DOE/ER/40682–11			
92-17	18:1849	*See* DOE/ER/40682–12			
92-18	18:1900	*See* DOE/ER/40682–13			
CNPE/HCT–					
12	18:1125	*See* Y/EN–4536/V1			
COG–					
92-141.	18:497	*See* AECL–10622			
92-151.	18:218	*See* AECL–10279			
92-177.	18:499	*See* AECL–10655			
CONF-860158–		(International meeting on nuclear physics; Bormio (Italy); 20-25 Jan 1986)			
9	18:1991	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000582	MF-413
CONF-8806523–		(2. workshop of participants in the joint FAO-IOC-WHO-IAEA-UNEP project on monitoring of pollution in the marine environment of the West and Central African region; Accra (Ghana); 13 Jun 1988)			
	18:134	*See* INIS-mf–13372			
CONF-8810561–		(WIM 2: 2. workshop on integrated monitoring; Espoo (Finland); 5-8 Oct 1988)			
	18:1542	*See* YMP-D–55/1988			
CONF-890696–		(10. annual conference of the Canadian Nuclear Association: nuclear fission–halfway to the first century; Ottawa (Canada); 4-7 Jun 1989)			
	18:508	*See* INFO–0319			
CONF-8908292–		(Post-conference seminar on small and medium-sized nuclear reactors; San Diego, CA (United States); 21-23 Aug 1989)			
	18:544	*See* AECL–9975			

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CONF-8908295–		(IOC-UNEP regional workshop to review priorities for marine pollution monitoring research, control and abatement in the wider Caribbean; San Jose (Costa Rica); 24 Aug 1989)			
	18:758	*See* INIS-mf–13370			
CONF-8909489–		(10. National Meeting on Physics of Particles and Fields; Itatiaia (Brazil); 20-24 Sep 1989)			
	18:1839	*See* INIS-BR–2934			
CONF-8909491–		(Conference on climate and water; Helsinki (Finland); 11-15 Sep 1989)			
	18:864	*See* VTT/LVIS2000–1			
Vol.1	18:1504	*See* SA-PUB–9/89-Vol.1			
Vol.2	18:1527	*See* SA-PUB–9/89-Vol.2			
CONF-891098–		(The scientific challenges of NEPA: future directions based on 20 years of experience; Knoxville, TN (United States); 24-27 Oct 1989)			
15	18:755	OSTI; NTIS; GPO Dep.	E 1.99:	DE92040705	MF-400
CONF-891119–		(Materials Research Society fall meeting; Boston, MA (United States); 27 Nov - 2 dec 1989)			
147	18:966	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93001366	MF-310; MF-404
CONF-8911264–		(9. Brazilian seminar of non destructive testing; Sao Paulo (Brazil); 5-8 Nov 1989)			
	18:316	*See* INIS-BR–2937			
	18:1263	*See* INIS-BR–2936			
CONF-9002140–		(Chaos down under; Sydney (Australia); Feb 1990)			
2	18:2190	*See* LA-UR–92-3126			
CONF-9003332–		(Seminar on building automation; Espoo (Finland); 8 Mar 1990)			
	18:865	*See* VTT/LVIS2000–4			
CONF-900402–		(199. national meeting of the American Chemical Society (ACS); Boston, MA (United States); 22-27 Apr 1990)			
13-Rev.	18:1474	*See* BNL–45879-Rev.			
CONF-9004365–		(National Science Foundation (NSF) workshop on mathematics and biology; Washington, DC (United States); 28 Apr - 3 may 1990)			
Summ.	18:1663	*See* LBL-PUB–701			
CONF-9004368–		(Seminar on energy systems in buildings; Espoo (Finland); 26 Apr 1990)			
	18:867	*See* VTT/LVIS2000–7			
CONF-9005332–		(2. International Seminar on Radioactive Waste Products; Juelich (Germany); 28 May - 1 jun 1990)			
	18:1547	*See* AECL–10182			
CONF-9006427–		(Seminar on indoor climate; Espoo (Finland); 7 Jun 1990)			
	18:866	*See* VTT/LVIS2000–6			
CONF-9006426–		(Seminar on Effects of organic contaminants in sewage sludge on soil fertility, plants and animals; Braunschweig (Germany); 6-8 Jun 1990)			
	18:131	*See* EUR–14236			
CONF-900833–		(6. American Council for an Energy-Efficient Economy (ACEEE) summer study on energy efficiency in buildings; Pacific Grove, CA (United States); 26 Aug - 1 sep 1990)			
18	18:831	*See* ANL/CP–77435			
CONF-900857–		(21. Mikolajki summer school on nuclear physics: nuclear and atomic physics with accelerators of the nineties; Mikolajki (Poland); 26 Aug - 5 sep 1990)			
	18:1990	*See* SINS–2106/A			
CONF-9009208–		(3. European community conference on radioactive waste management and disposal; Luxembourg (Luxembourg); 17-21 Sep 1990)			
	18:465	*See* CEA-CONF–10968			

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CONF-9009441–		(Summer school of particle physics; Strasbourg (France); 3-7 Sep 1990)			
	18:1959	*See* IN2P3–92-02			
CONF-9010509–		(Seminar on algae as bioindicators for radionuclides in Nordic coastal waters; Forsmark (Sweden); 16 Oct 1990)			
	18:1641	*See* NKS-RAD–2-91-2			
CONF-9010521–		(FINNWIND'90: conference on wind power in Finland; Pori (Finland); 19-20 Oct 1990)			
	18:406	*See* NEI-FI–168			
CONF-9010522–		(Energy- and environmental perspectives for Norway; Kjeller (Norway); 11 Oct 1990)			
1	18:763	*See* NEI-NO–276			
2	18:762	*See* NEI-NO–275			
CONF-901155–		(American Institute of Chemical Engineers (AIChE) fall annual meeting; Chicago, IL (United States); 11-16 Nov 1990)			
8	18:1201	*See* DOE/ER/13572–3			
CONF-901219–		(International symposium on heavy ion inertial fusion; Monterey, CA (United States); 3-6 Dec 1990)			
17	18:2388	*See* LBL–30340			
CONF-9103193–		(Stan Hanna Mossbauer spectroscopy workshop; Stanford, CA (United States); 15-16 Mar 1991)			
2	18:2014	*See* ANL/CP–76905			
CONF-9103264–		(Proceedings of a Workshop on Hydrogen behaviour and mitigation in water-cooled nuclear power reactors; Brussels (Belgium); 4-8 Mar 1991)			
	18:445	*See* EUR–14039			
CONF-9104386–		(6. Korea Atomic Industrial Forum/Korea Nuclear Society (KAIF/KNS) joint annual conference; Seoul (Korea, Republic of); 15 Apr 1991)			
	18:463	*See* AECL–10390			
CONF-9104394–		(5. Latin American Congress of Ultrasound in Medicine and Biology; Seminar of the Inter American College of Radiology; Sao Paulo (Brazil); 14-17 Apr 1991)			
	18:1682	*See* INIS-BR–2939			
CONF-9104396–		(2. international workshop on Human Chromosome 3; Denver, CO (United States); 4-5 Apr 1991)			
Absts.	18:1672	*See* DOE/ER/61162–1			
CONF-910454–		(International ANS/ENS topical meeting on LWR fuel performance: fuel for the 90s; Avignon (France); 21-24 Apr 1991)			
	18:495	*See* AECL–10388			
CONF-910503–		(International conference on nuclear data for science and technology; Juelich (Germany); 13-17 May 1991)			
25	18:306	*See* BNL–47949			
CONF-910535–		(6. specialists meeting on reactor noise (SMORN); Gatlinburg, TN (United States); 19-24 May 1991)			
	18:597	*See* ECN-RX–91-057			
CONF-9105355–		(14. national meeting on condensed matter physics; Caxambu (Brazil); 7-11 May 1991)			
	18:2093	*See* INIS-BR–2933			
CONF-9105381–		(IOC-United Nations Environment Programme (UNEP) review meeting on oceanographic processes of transport and distribution of pollutants in the sea; Zagreb (Yugoslavia); 15 May 1991)			
	18:1638	*See* INIS-mf–13371			
CONF-9106310–		(2. international symposium on fusion nuclear technology and exposition; Karlsruhe (Germany); 2-7 Jun 1991)			
	18:2362	*See* ECN-RX–91-074			

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CONF-9106378–		(12. annual conference of the Canadian Nuclear Society; Saskatoon (Canada); 9-12 Jun 1991)			
	18:496	*See* AECL–10426			
CONF-9106396–		(21. Southern forest tree improvement conference (SFTIC); Knoxville, TN (United States); 17-20 Jun 1991)			
1	18:1551	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92040874	MF-402
CONF-9106402–		(Meeting of the contractors of the research and development programme into wind energy 1990-1992; Maastricht (Netherlands); 12-14 Jun 1991)			
	18:410	*See* EUR–13837			
CONF-9106403–		(Workshop on Pilot tests on radioactive waste disposal in underground facilities; Braunschweig (Germany); 19-20 Jun 1991)			
	18:234	*See* EUR–13985			
CONF-910714–		(International topical meeting on safety of thermal reactors; Portland, OR (United States); 21-25 Jul 1991)			
	18:158	*See* AECL–10438			
CONF-9107237–		(Renewable energy sources '91 international conference; Prague (Czechoslovakia); 1 Jul 1991)			
	18:801	*See* INIS-mf–13362			
	18:802	*See* INIS-mf–13363			
CONF-910751–		(Institute of Electrical and Electronic Engineers (IEEE) annual international nuclear and space radiation effects conference; San Diego, CA (United States); 15-19 Jul 1991)			
	18:1444	*See* CEA-CONF–11022			
CONF-9108118–		(13. international free-electron laser (FEL) conference; Santa Fe, NM (United States); 25-30 Aug 1991)			
49	18:1271	*See* CEA-CONF–10977			
CONF-9108137–		(Asilomar conference on transportation and global climate change: long range options; Pacific Grove, CA (United States); 25-28 Aug 1991)			
4	18:871	*See* LBL–32384			
CONF-910815–		(2. international conference on radioactive nuclear beams; Louvain (Belgium); 19-21 Aug 1991)			
	18:1706	*See* IPNO-DRE–91-27			
CONF-9108189–		(5. rf superconductivity workshop at DESY; Hamburg (Germany); 19-21 Aug 1991)			
	18:1361	*See* IPNO–91-07			
CONF-9108222–		(1. Baltic heat transfer conference; Goeteborg (Sweden); 26-28 Aug 1991)			
1	18:1240	*See* DTH-AFM–91-04			
CONF-910905–		(5. international symposium on the natural radiation environment; Salzburg (Austria); 22-28 Sep 1991)			
4	18:1757	*See* LBL–32179			
CONF-9109114–		(6. symposium on containment of underground nuclear explosions; Reno, NV (United States); 24-26 Sep 1991)			
Vol.1	18:1464	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92041091	MF-742
Vol.2	18:1465	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92041092	MF-742
CONF-910920–		(4. topical meeting on tritium technology in fission, fusion, and isotopic applications; Albuquerque, NM (United States); 29 Sep - 4 oct 1991)			
	18:223	*See* CEA-CONF–11027			
CONF-9109232–		(RADECS 91: radiation effects on components and systems; Montpellier (France); 9-12 Sep 1991)			
	18:1443	*See* CEA-CONF–10967			
	18:1445	*See* CEA-CONF–11023			
	18:1446	*See* CEA-CONF–11024			
	18:1447	*See* CEA-CONF–11025			
	18:1448	*See* CEA-CONF–11026			

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CONF-9109278–		(International Joliot-Curie summer school of nuclear physics; Maubuissen (France); 16-21 Sep 1991)			
	18:1997	*See* IN2P3–92-01			
CONF-9109417–		(Iran's physics conference; Isfahan (Iran, Islamic Republic of); 10 Sep 1991)			
	18:1781	*See* INIS-mf–13349			
CONF-910943–		(4. international conference on ion sources; Bensheim (Germany); 30 Sep - 4 oct 1991)			
6	18:1381	*See* LBL–30451			
CONF-9109436–		(Workshop on Composting and Compost Quality Assurance Criteria; Angers (France); 11-13 Sep 1991)			
	18:886	*See* EUR–14254			
CONF-9109440–		(23. School on Particle Physics: Electroweak properties of heavy quarks; Palaiseau (France); Sep 1991)			
	18:1952	*See* PCCF-RI–92-07			
CONF-9109441–		(2. Seminar on practical decommissioning experience with nuclear installations in the European Community; Sellafield (United Kingdom); 25-26 Sep 1991)			
	18:1209	*See* EUR–14363			
CONF-911001–		(International conference on fast reactor systems and fuel cycles; Kyoto (Japan); 27 Oct - 1 nov 1991)			
26	18:516	*See* ANL/CP–72040			
CONF-9110289–		(International symposium on reflections and directions in low energy heavy ion physics; Oak Ridge, TN (United States); 14-15 Oct 1991)			
5	18:1992	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93001713	MF-413
CONF-9110419–		(Energy for Europe; Oslo (Norway); 14-15 Oct 1991)			
	18:791	*See* NORD–91-53			
CONF-9110428–		(Conference on artificial dewatering of peat; Jyvaeskylae (Finland); 15-16 Oct 1991)			
	18:10	*See* VTT-SYMP–134			
CONF-9110434–		(OECD/NEA/CSNI Specialist Meeting on Safety and Risk Assessment in Fuel Cycle Facilities; Tokyo (Japan); 7-9 Oct 1991)			
	18:191	*See* CEA-CONF–10994			
	18:192	*See* CEA-CONF–10995			
CONF-911049–		(7. symposium on separation science and technology for energy applications; Knoxville, TN (United States); 20-24 Oct 1991)			
	18:188	*See* CEA-CONF–10979			
	18:1189	*See* CEA-CONF–10978			
CONF-911106–		(1991 Institute of Electrical and Electronic Engineers (IEEE) nuclear science symposium and medical imaging conference; Santa Fe, NM (United States); 2-9 Nov 1991)			
62-Rev.	18:1343	*See* BNL–46833-Rev.			
CONF-911109–		(Fall meeting of the European Materials Research Society; Strasbourg (France); 5-8 Nov 1991)			
	18:1084	*See* CEA-CONF–11028			
CONF-9111208–		(19. INFN eloisation project: maximizing luminosity of hadron colliders at 100 TeV; Erice (Italy); 13-19 Nov 1991)			
3	18:1377	*See* LA-UR–92-2998			
CONF-911123–		(15. international symposium on the scientific basis for nuclear waste management; Strasbourg (France); 5-8 Nov 1991)			
	18:1079	*See* CEA-CONF–10989			
	18:1080	*See* CEA-CONF–10990			
	18:1081	*See* CEA-CONF–10991			
	18:1082	*See* CEA-CONF–10992			
	18:1083	*See* CEA-CONF–10993			
CONF-9111267–		(Tank waste science panel; Pasco, WA (United States); 11-13 Nov 1991)			
	18:253	*See* PNL–8047			

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CONF-911202–		(Annual fall meeting of the Materials Research Society; Boston, MA (United States); 2-6 Dec 1991)			
85	18:1074	*See* LBL–32258			
CONF-9112138–		(21. Congress of science et tradition: perspectives transdiciplinaries, ouvertures vers eme siecle at l'U.N.E.S.C.O.; Paris (France); 2-6 Dec 1991)			
1	18:1832	*See* LBL–31565			
CONF-920108–		(International air conditioning, heating, refrigerating exposition; Anaheim, CA (United States); 25-29 Jan 1992)			
3	18:845	*See* LBL–29752			
CONF-9201107–		(Adriatico research conference on polarization dynamics in nuclear and particle physics; Trieste (Italy); 7-10 Jan 1992)			
9	18:1308	*See* BNL–47948			
CONF-9201118–		(12. Material days of guided optics; Paris (France); 23-24 Jan 1992)			
	18:1350	*See* CEA-CONF–11041			
CONF-920119–		(17. workshop on geothermal reservoir engineering; Stanford, CA (United States); 29-31 Jan 1992)			
4	18:404	*See* LBL–32357			
CONF-920142–		(International topical conference on new ideas in tokamak confinement; La Jolla, CA (United States); 27-29 Jan 1992)			
2	18:2305	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000443	MF-427
CONF-920146–		(ASTM international symposium on small specimen test techniques and their applications to nuclear reactor vessel thermal annealing and plant life extension; New Orleans, LA (United States); 29-31 Jan 1992)			
6	18:2358	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93001374	MF-421
CONF-9202111–		(4. generation light sources workshop; Stanford, CA (United States); 24-27 Feb 1992)			
7	18:1290	*See* BNL–47856			
CONF-9202130–		(Ocean climate data workshop; Greenbelt, MD (United States); 18 Feb 1992)			
	18:757	*See* INIS-mf–13360			
CONF-9202137–		(1. annual conference on evolutionary programming; La Jolla, CA (United States); 21-22 Feb 1992)			
1	18:1202	OSTI; NTIS; GPO Dep.	E 1.99:	DE92041307	MF-406
CONF-920219–		(6. international wire chamber conference: wire chambers - recent trends and alternative techniques; Vienna (Austria); 17-21 Feb 1992)			
6	18:1399	*See* BNL–47329			
CONF-920311–		(10. international conference on plasma-surface interactions in controlled fusion devices; Monterey, CA (United States); 30 Mar - 3 apr 1992)			
	18:2370	*See* EUR-CEA-FC–1456			
CONF-920315–		(3. European particle accelerator conference; Berlin (Germany); 24-28 Mar 1992)			
	18:2200	*See* CEA-CONF–10987			
	18:2348	*See* CEA-CONF–10980			
CONF-9203154–		(27. Rencontres de Moriond, QCD and high energy hadronic interactions; Les Arcs (France); 22-28 Mar 1992)			
	18:1921	*See* NIKHEF-H/K–92-01			
CONF-9203159–		(9. international workshop on photon-photon collisions; San Diego, CA (United States); 22-26 Mar 1992)			
8	18:1331	*See* SLAC-PUB–5914			
CONF-9203162–		(International symposium on spectroscopy and structure of molecules and nuclei; Tallahassee, FL (United States); 27 Mar 1992)			
3	18:1982	*See* UCRL-JC–110734			

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CONF-9203186–		(Colloquium of the French Society of Radioprotection; Paris (France); 27 Mar 1992)			
	18:213	*See* CEA-CONF–10983			
CONF-9203193–		(1992 DOE-industry thermal distribution conference; Washington, DC (United States); 30-31 Mar 1992)			
	18:832	*See* BNL–52341			
CONF-9203195–		(Proceedings of the General Meeting on LHC Physics and Detectors; Evian (France); 5-8 Mar 1992)			
	18:2199	*See* CEA-CONF–10986			
CONF-9203196–		(INFAUTON 92: Operational expert systems; Toulouse (France); 12-13 Mar 1992)			
	18:464	*See* CEA-CONF–10942			
CONF-9203197–		(27. Rencontres de Moriond: 'Electroweak Interactions and Unified Theories'; Les Arcs (France); 15-22 Mar 1992)			
	18:1951	*See* LAL–92-26			
	18:1973	*See* LAL–92-27			
CONF-9203198–		(Tame Lab Meeting; Ispra (Italy); 25-27 Mar 1992)			
	18:190	*See* CEA-CONF–10985			
CONF-9203199–		(Meeting on Technology; Paris (France); 24-25 Mar 1992)			
	18:2198	*See* CEA-CONF–10984			
CONF-920331–		(International industrial symposium on the super collider; New Orleans, LA (United States); 4-6 Mar 1992)			
55	18:1307	*See* BNL–47601			
56	18:1358	*See* FNAL/C–92/97			
57	18:1357	*See* FNAL/C–92/95			
58	18:1359	*See* FNAL/C–92/102			
CONF-920375–		(Aging research information conference; Rockville, MD (United States); 24-27 Mar 1992)			
Vol.1	18:717	*See* NUREG/CP–0122-Vol.1			
Vol.2	18:582	*See* NUREG/CP–0122-Vol.2			
CONF-920378–		(Geothermal energy program review: geothermal energy and the utility market–the opportunities and challenges for expanding geothermal energy in a competitive supply market; San Francisco, CA (United States); 24-26 Mar 1992)			
10	18:395	*See* LBL–32139			
CONF-920402–		(Material Research Society spring meeting; San Francisco, CA (United States); 27 Apr - 2 may 1992)			
59	18:1076	*See* LBL–32513			
60	18:2471	*See* LBL–32512			
CONF-920405–		(B factories: state of the art in accelerators, detectors, and physics; Spring meeting of the American Physical Society; Stanford, CA (United States); Washington, DC (United States); 6-10 Apr 1992; 20-24 apr 1992)			
2	18:1327	*See* LBL–32561			
CONF-9204126–		(B factories: state of the art in accelerators, detectors, and physics; Stanford, CA (United States); 6-10 Apr 1992)			
10	18:1382	*See* LBL–32446			
11	18:1326	*See* LBL–32516			
12	18:1385	*See* LBL–32468			
13	18:1327	*See* LBL–32561			
CONF-9204164–		(International symposium on the measurement of primary production from the molecular to global scale; La Rochelle (France); 19-26 Apr 1992)			
2	18:1625	*See* BNL–47937			
CONF-9204186–		(Future direction in electron-ion collision physics; Atlanta, GA (United States); 9-10 Apr 1992)			
	18:2080	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000500	MF-700

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-9204195–		(1992 Israel Physical Society annual meeting; Rehovot (Israel); 15 Apr 1992)			
	18:1783	*See* INIS-mf–13358			
CONF-9204201–		(22. Meeting Actinides; Meribel (France); 22-25 Apr 1992)			
	18:189	*See* CEA-CONF–10982			
CONF-9204202–		(Conference on traffic; Humlebaek (Denmark); 10 Apr 1992)			
	18:1770	*See* NEI-DK–974			
CONF-9204203–		(Gentnet-Kastler Price; Berlin (Germany); 1 Apr 1992)			
	18:2100	*See* CEA-CONF–11036			
CONF-9204204–		(The Kangaroo Group Energy Conference; Paris (France); 3-4 Apr 1992)			
	18:777	*See* CEA-CONF–10966			
CONF-920430–		(3. international high level radioactive waste management (IHLRWM) conference; Las Vegas, NV (United States); 12-16 Apr 1992)			
	18:220	*See* CEA-CONF–10808			
	18:221	*See* CEA-CONF–10981			
CONF-920450–		(4. conference on frontiers of electron microscopy in materials science; Oakland, CA (United States); 21-24 Apr 1992)			
1	18:1014	*See* LBL–32290			
CONF-920463–		(11. international conference and exhibits on NDE in the nuclear and pressure vessel industries; Albuquerque, NM (United States); 29 Apr - 3 may 1992)			
	18:1260	*See* CEA-CONF–11029			
	18:1261	*See* CEA-CONF–11030			
	18:1262	*See* CEA-CONF–11031			
CONF-9205108–		(International conference on nuclear structure at high angular momentum; Ottawa (Canada); 18-21 May 1992)			
2	18:1993	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92041016	MF-413
15	18:2005	*See* LBL–32497			
CONF-9205116–		(International conference on irradiation technology; Saclay (France); 20-22 May 1992)			
	18:554	*See* CEA-CONF–10965			
CONF-9205118–		(2. international conference on effects of low-dose ionizing radiation; Bournemouth (United Kingdom); 18-20 May 1992)			
	18:1748	*See* INFO–0416			
CONF-9205123–		(6. annual fossil energy materials conference; Oak Ridge, TN (United States); 12-14 May 1992)			
	18:51	*See* ORNL/FMP–92/1			
13	18:424	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000724	MF-106
CONF-9205210–		(2. annual conference on electronics for future colliders; Chestnut Ridge, NY (United States); 19-21 May 1992)			
3	18:1442	*See* UCRL-JC–111225			
CONF-9205232–		(11. American Society for Testing and Materials (ASTM) symposium on composite materials: testing and design; Pittsburgh, PA (United States); 4-5 May 1992)			
1	18:1122	*See* UCRL-JC–110665			
CONF-9205236–		(Conference on phase separation in cuprate superconductors; Sicily (Italy); 6-12 May 1992)			
4	18:1072	*See* LA-UR–92-3086			
CONF-9205243–		(16. DOE solar photochemistry research conference; Delavan, WI (United States); 31 May - 4 jun 1992)			
	18:368	OSTI; NTIS; GPO Dep.	,E 1.99:	DE93001760	MF-401
CONF-9205253–		(NATO workshop on numerical methods for partial differential equations and critical parameters; Beaune (France); 25-28 May 1992)			
1	18:2415	*See* ANL/CP–77114			
CONF-9205256–		(6th SATURNE days; Mont Sainte-Odile (France); 18-22 May 1992)			
	18:1293	*See* CEA-LNS-GT–92-05			

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	18:1956	*See* CEA-LNS-Ph–92-17			
CONF-920532–		(15. annual conference of the International Association for Energy Economics; Tours (France); 18-20 May 1992)			
	18:754	*See* CEA-CONF–10988			
CONF-920584–		(US Department of Energy contractor review meeting on natural gas research and development; Morgantown, WV (United States); 5-6 May 1992)			
12	18:141	*See* DOE/MC/27260–92/C0043			
29	18:142	*See* DOE/MC/28080–92/C0066			
30	18:143	*See* DOE/MC/28239–92/C0067			
CONF-920607–		(10. topical meeting on technology of fusion energy; Boston, MA (United States); 7-12 Jun 1992)			
	18:2349	*See* CEA-CONF–10999			
	18:2350	*See* CEA-CONF–11000			
	18:2351	*See* CEA-CONF–11001			
	18:2352	*See* CEA-CONF–11002			
CONF-9206131–		(3. international symposium on the history of particle physics - the rise of the standard model; Stanford, CA (United States); 24-27 Jun 1992)			
2	18:1978	*See* LBL–32514			
CONF-9206135–		(1992 international thermal spray conference; Orlando, FL (United States); 1-5 Jun 1992)			
6	18:895	*See* SAND–92-1290C			
7	18:1227	*See* SAND–92-1288C			
8	18:1020	*See* SAND–92-1289C			
CONF-920614–		(International cryogenic engineering conference and the international cryogenic materials conference; Kiev (Ukraine); 8-12 Jun 1992)			
3	18:1432	*See* LBL–32526			
4	18:1013	*See* LBL–32095			
CONF-9206175–		(Interaction symposium on metal-hydrogen systems; Uppsala (Sweden); Jun 1992)			
	18:958	*See* CEA-CONF–10998			
	18:2098	*See* CEA-CONF–10996			
	18:2099	*See* CEA-CONF–10997			
CONF-9206185–		(7. International Association of Mathematics and Computer Simulation (IMACS) international conference on computer methods for partial differential equations; New Brunswick, NJ (United States); 22-24 Jun 1992)			
10-Rev.1	18:1334	*See* SSCL-Preprint–138-Rev.1			
CONF-9206193–		(Advanced accelerator concepts workshop; Port Jefferson, NY (United States); 14-20 Jun 1992)			
9	18:1342	*See* ANL/HEP-CP–92-72			
10	18:1347	*See* BNL–47827			
11	18:1325	*See* LBL–32222-Exc.			
12	18:1379	*See* LA-UR–92-3165			
14	18:1384	*See* LBL–32463			
CONF-9206194–		(3. international conference on advances in fusion and processing of glass; New Orleans, LA (United States); 10-12 Jun 1992)			
13	18:1324	*See* LBL–31848			
CONF-9206195–		(1992 powder metallurgy world congress; San Francisco, CA (United States); 21-26 Jun 1992)			
	18:960	*See* CEA-CONF–11035			
CONF-9206202–		(NATO advanced study institute on statics and dynamics of alloy phase transformations; Rhodes (Greece); 21 Jun - 3 jul 1992)			
2	18:967	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000436	MF-404
3	18:955	*See* ANL/MSD/CP–77632			
CONF-9206227–		(15. international conference on neutrino physics; Granada (Spain); 7-13 Jun 1992)			
2	18:1976	*See* LA-UR–92-3194			

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CONF-9206235--		(International Atomic Energy Agency (IAEA) technical committee meeting on advances in simulation and modeling of thermonuclear plasmas; Montreal (Canada); 15 Jun 1992)			
2	18:2323	*See* DOE/ET/53088-567			
CONF-920625--		(Conference on rare earths; Kyoto (Japan); 1-5 Jun 1992)			
6	18:1173	*See* LBL-32473			
CONF-9206251--		(Physics beyond the standard model III conference; Ottawa (Canada); 22-24 Jun 1992)			
2	18:1977	*See* LA-UR-92-3208			
CONF-9206274--		(US Army Chemical Research Development Engineering Center (CRDEC) conference on obscuration and aerosol research; Aberdeen Proving Grounds, MD (United States); 22-26 Jun 1992)			
2	18:1149	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000439	MF-401; MF-410
CONF-9206275--		(Nobel symposium on heavy ion spectroscopy and QED effects in atomic systems; Saltsjoebaden (Sweden); 29 Jun - 3 jul 1992)			
2	18:2163	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93001371	MF-411
CONF-9206276--		(Muon '92 workshop; Uppsala (Sweden); 28 Jun - 3 jul 1992)			
2	18:2088	*See* LA-UR-92-3046			
CONF-9206280--		(Workshop on QCD vacuum structure; Paris (France); 1-5 Jun 1992)			
1	18:1898	*See* ANL/CP-77129			
CONF-9206281--		(ICFA workshop on AC superconductivity; Tsukuba (Japan); 23-25 Jun 1992)			
2	18:1346	*See* BNL-47621			
1-Rev.A	18:1389	*See* SSCL-Preprint-134-Rev.A			
CONF-9206284--		(7. international symposium on very high energy cosmic ray interactions; Ann Arbor, MI (United States); 21-27 Jun 1992)			
1	18:1440	*See* SLAC-PUB-5927			
CONF-9206289--		(21. differential geometric methods in theoretical physics (DGMTP) conference; Tianjin (China); 5 Jun 1992)			
1	18:1842	*See* ANL-HEP-CP-92-53			
CONF-9206290--		(6. international conference on domain decomposition methods in science and engineering; Como (Italy); 14-21 Jun 1992)			
1	18:2418	*See* BNL-47892			
CONF-9206292--		(International conference on physics in collisions; Boulder, CO (United States); 9-12 Jun 1992)			
1	18:1931	*See* FNAL/C-92/232			
CONF-9206295--		(1. International conference and exhibition on biological waste treatment; Herning (Denmark); 1-4 Jun 1992)			
	18:931	*See* NEI-DK-957			
CONF-9206296--		(Specialist Meeting on Cladding and Wrapper Materials; Obninsk (Russian Federation); 7-14 Jun 1992)			
	18:961	*See* CEA-CONF-11037			
	18:962	*See* CEA-CONF-11038			
	18:963	*See* CEA-CONF-11039			
	18:964	*See* CEA-CONF-11040			
CONF-9206299--		(6. Conference on Electrostatic Accelerators and Associated Boosters; Padova (Italy); 1-5 Jun 1992)			
	18:2032	*See* GANIL-A-92-02			
CONF-920630--		(1. world congress for electricity and magnetism in biology and medicine; Orlando, FL (United States); 14-29 Jun 1992)			
2	18:1767	*See* ANL/CP-77257			
CONF-9206300--		(International Conference on Institute of Refrigeration; Kiev (USSR); 8-12 Jun 1992)			
	18:1813	*See* CEA-CONF-11032			

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CONF-920631–		(American Society of Mechanical Engineers pressure vessel and piping conference; New Orleans, LA (United States); 21-25 Jun 1992)			
47	18:1222	*See* SAND–91-2255C			
CONF-920638–		(19. Institute of Electrical and Electronic Engineers (IEEE) international conference on plasma science; Tampa, FL (United States); 1-3 Jun 1992)			
1	18:1229	*See* UCRL-JC–109423			
CONF-920670–		(6. international conference on intergranular and interphase boundaries in materials; Thessaloniki (Greece); 22-26 Jun 1992)			
5	18:1123	*See* UCRL-JC–111033			
CONF-920676–		(Electronic materials conference; Cambridge, MA (United States); 24-26 Jun 1992)			
2	18:1119	*See* SAND–92-0392C			
CONF-920701–		(10. international congress on catalysis; Budapest (Hungary); 19-24 Jul 1992)			
2	18:1171	*See* LBL–31675			
CONF-920706–		(International conference on high energy accelerators; Hamburg (Germany); 20-24 Jul 1992)			
34	18:1329	*See* LBL–32581			
35	18:1299	*See* LBL–32250			
36	18:1315	*See* FNAL/C–92/219			
37	18:1328	*See* LBL–32580			
38	18:1332	*See* SLAC-PUB–5920			
CONF-920708–		(2. international nuclear physics conference; Wiesbaden (Germany); 26 Jul - 1 aug 1992)			
5	18:2013	*See* UCRL-JC–109657			
CONF-9207102–		(Institute of Nuclear Materials Management (INMM) annual meeting; Orlando, FL (United States); 19-22 Jul 1992)			
56	18:300	*See* SAND–92-0684C			
58	18:553	*See* BNL–47071			
CONF-9207113–		(2. international symposium on nuclear astrophysics: nuclei in the cosmos; Karlsruhe (Germany); 6-10 Jul 1992)			
3	18:1833	*See* LBL–32562			
CONF-9207140–		(Stanford Linear Accelerator Center (SLAC) summer institute on particle accelerators: third family and the physics of flavor; Stanford, CA (United States); 13-24 Jul 1992)			
1	18:1897	*See* SLAC-PUB–5874			
CONF-9207149–		(Hyperfine interactions of the anti-hydrogen workshop; Munich (Germany); 30-31 Jul 1992)			
2	18:2089	*See* SLAC-PUB–5939			
CONF-9207150–		(US-Japan seminar on microfabrication of biosensors; Anchorage, AK (United States); 21-24 Jul 1992)			
1	18:950	*See* SAND–92-1599C			
CONF-9207153–		(Institute of Electrical and Electronic Engineers (IEEE) magnetic recording conference; Santa Clara, CA (United States); 21-23 Jul 1992)			
1	18:1116	*See* LBL–32388			
CONF-9207155–		(Quantitative nondestructive evaluation conference; San Diego, CA (United States); 19-24 Jul 1992)			
1	18:1454	*See* UCRL-JC–111214			
CONF-9207156–		(International Astronomical Union (IAU) colloquium 139 on new perspectives on stellar pulsation and pulsating variable stars; Victoria (Canada); 7-11 Jul 1992)			
1	18:1831	*See* LA-UR–92-2946			
CONF-920717–		(Topical conference meeting on radio frequency heating and current drive of fusion devices; Brussels (Belgium); 7-10 Jul 1992)			
5	18:2330	*See* GA-A–21003			

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CONF-920721–		(6. international conference on nuclei far from stability and 9th international conference on atomic masses and fundamental constants; Bernkastel-Kues (Germany); 19-24 Jul 1992)			
11	18:2015	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92040866	MF-413
13	18:2016	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93001646	MF-413
CONF-920736–		(8. coal preparation, utilization, and environmental control conference; Pittsburgh, PA (United States); 26-31 Jul 1992)			
	18:1	OSTI; NTIS; GPO Dep.	E 1.99:	DE92041184	MF-102
CONF-920741–		(13 international conference on cyclotrons and their applications; Vancouver (Canada); 6-16 Jul 1992)			
4	18:2389	*See* LBL–32038			
5	18:1386	*See* LBL–32680			
CONF-920749–		(US Department of Energy contractors review meeting on fuel cells; Morgantown, WV (United States); 14-15 Jul 1992)			
22	18:828	*See* DOE/MC/27394–92/C0047			
CONF-920762–		(International conference on the physics of transition metals; Darmstadt (Germany); 20-24 Jul 1992)			
5	18:1018	*See* LBL–32711			
6	18:951	*See* ANL/CP–76266			
7	18:1027	*See* UCRL-JC–110724			
CONF-920768–		(Conference on physics and engineering of advanced detectors and collection/focusing systems; San Diego, CA (United States); 19-24 Jul 1992)			
6	18:2392	*See* UCRL-JC–110021			
CONF-920792–		(Society of Photo-Optical Instrumentation Engineers (SPIE) international symposium on optical applied science and engineering; San Diego, CA (United States); 19-24 Jul 1992)			
32	18:1348	*See* BNL–47890			
35	18:1340	*See* ANL/CP–77256			
36	18:1339	*See* ANL/CP–77003			
37	18:1026	*See* UCRL-JC–109382			
CONF-920801–		(27. intersociety energy conversion engineering conference; San Diego, CA (United States); 3-7 Aug 1992)			
24	18:739	*See* PNL-SA–20796			
25	18:740	*See* PNL-SA–21032			
26	18:1221	*See* PNL-SA–20751			
CONF-920802–		(Applied superconductivity conference; Chicago, IL (United States); 23-28 Aug 1992)			
6	18:736	*See* ANL/CP–77105			
10	18:869	*See* ANL/CP–76181			
11	18:1029	*See* ANL/CP–77169			
12	18:1035	*See* BNL–47891			
13	18:2195	*See* ANL/CP–77139			
14	18:2201	OSTI; NTIS; GPO Dep.	E 1.99:	DE92040864	
15	18:2228	*See* LA-UR–92-3055			
17	18:1071	*See* LA-UR–92-3069			
18	18:1032	*See* ANL/CP–77431			
19	18:1073	*See* LA-UR–92-3188			
20	18:1034	*See* ANL/CP–77433			
21	18:1031	*See* ANL/CP–77430			
22	18:1033	*See* ANL/CP–77432			
23	18:2197	*See* BNL–47325			
CONF-920804–		(American Society of Mechanical Engineers national heat transfer conference and exposition; San Diego, CA (United States); 9-12 Aug 1992)			
24	18:1234	*See* DOE/ER/12933–3			
25	18:1259	*See* WSRC-MS–91-416			
26	18:377	*See* PNL-SA–20025			
CONF-920808–		(American Institute of Chemical Engineers (AIChE) summer national meeting; Minneapolis, MN (United States); 9-12 Aug 1992)			
9	18:71	*See* ANL/CP–75263			

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10	18:259	*See* PNL-SA–21233			
CONF-9208103–		(INTER-RAMQ conference for electric power industry; Philadelphia, PA (United States); 25-28 Aug 1992)			
2	18:724	*See* PNL-SA–18921			
CONF-9208109–		(16. international LINAC conference; Ottawa (Canada); 23-28 Aug 1992)			
48	18:1335	*See* ANL/CP–75928			
49	18:1336	*See* ANL/CP–75930			
50	18:1289	*See* ANL-HEP-CP–92-65			
53	18:1297	*See* LA-UR–92-2968			
54	18:1345	*See* BNL–47453			
55	18:1288	*See* LBL–32734			
56	18:1292	*See* BNL–47909			
57	18:1305	*See* ANL/CP–77445			
58	18:1341	*See* ANL/CP–77444			
59	18:1304	*See* ANL/CP–77399			
60	18:1306	*See* ANL/CP–77446			
61	18:1323	*See* LA-UR–92-2768			
62	18:1376	*See* LA-UR–92-2816			
64	18:2196	*See* ANL/CP–77443			
65	18:1285	*See* ANL/CP–77442			
CONF-9208114–		(American Nuclear Society meeting; Jackson Hole, WY (United States); 16-19 Aug 1992)			
4	18:537	*See* PNL-SA–20523			
CONF-9208117–		(1992 Energy Facility Contractors Group (EFCOG) safety analysis workshop; Salt Lake City, UT (United States); 11-13 Aug 1992)			
11	18:1761	*See* WSRC-MS–92-212			
12	18:1536	*See* WSRC-MS–92-211			
CONF-9208129–		(41. annual Denver x-ray conference; Denver, CO (United States); Aug 1992)			
3	18:1085	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000440	MF-404
4	18:1120	*See* SAND–92-1813C			
CONF-9208142–		(14. international free electron laser conference; Kobe (Japan); 23-28 Aug 1992)			
3	18:1337	*See* ANL/CP–76108			
4	18:1291	*See* BNL–47857			
5	18:1378	*See* LA-UR–92-3017			
CONF-9208143–		(Alfred Benzon symposium 35 on DNA repair mechanism; Copenhagen (Denmark); 8-13 Aug 1992)			
1	18:1762	OSTI; NTIS; GPO Dep.	E 1.99:	DE93001208	MF-408
CONF-9208149–		(3. International Environmetrics Society (IES) conference; Espoo (Finland); 17-21 Aug 1992)			
1	18:1502	*See* PNL-SA–20951			
CONF-920815–		(204. American Chemical Society national meeting; Washington, DC (United States); 23-28 Aug 1992)			
9	18:21	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000704	MF-102
CONF-9208152–		(ISSS working group meeting; Edmonton (Canada); 10-16 Aug 1992)			
1	18:1174	*See* PNL-SA–21261			
CONF-9208154–		(43. Congress of the International Astronautical Federation; Washington, DC (United States); 28 Aug - 5 sep 1992)			
1	18:535	OSTI; NTIS; GPO Dep.	E 1.99:	DE92041262	MF-528
CONF-9208155–		(9. international congress on photosynthesis; Nagoya (Japan); 30 Aug - 5 sep 1992)			
1	18:1182	*See* ANL/CP–76566			
CONF-9208159–		(IABEM-2: International Association for Boundary Elements (IABE) meeting; Boulder, CO (United States); 2-5 Aug 1992)			
1	18:2419	OSTI; NTIS; GPO Dep.	E 1.99:	DE92041266	MF-405
CONF-920821–		(4. international conference on biophysics and synchrotron radiation; Tsukuba (Japan); 30 Aug - 5 sep 1992)			
1	18:1676	*See* BNL–47916			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-920825–		(21. international conference on the physics of semiconductors; Beijing (China); 10-14 Aug 1992)			
1	18:1019	*See* LBL–32715			
CONF-920828–		(American Council for an Energy-Efficient Economy (ACEEE) summer study on energy efficiency in buildings; Pacific Grove, CA (United States); 30 Aug - 5 sep 1992)			
10	18:751	OSTI; NTIS; GPO Dep.	E 1.99:	DE92040867	MF-350
11	18:861	*See* PNL-SA–20909			
12	18:863	*See* PNL-SA–21019			
13	18:862	*See* PNL-SA–20976			
14	18:783	*See* LBL–32214			
15	18:859	*See* PNL-SA–20288			
16	18:848	*See* LBL–32257			
18	18:860	*See* PNL-SA–20804			
CONF-920837–		(26. international conference on high energy physics; Dallas, TX (United States); 6-12 Aug 1992)			
5	18:1925	*See* BNL–47885			
6	18:1975	*See* LA-UR–92-3192			
7	18:1333	*See* SSCL-Preprint–137			
CONF-920843–		(3. Institute of Electrical and Electronic Engineers (IEEE) workshop on computers in power electronics; Berkeley, CA (United States); 9-11 Aug 1992)			
1	18:1380	*See* LA-UR–92-3203			
CONF-920851–		(Spectrum '92: nuclear and hazardous waste management international topical meeting; Boise, ID (United States); 23-27 Aug 1992)			
75	18:257	*See* PNL-SA–20941			
CONF-920853–		(Nonlinear optics: materials, fundamentals, and applications; Maui, HI (United States); 17-21 Aug 1992)			
4	18:1459	*See* UCRL-JC–109606-R1			
CONF-920879–		(World space congress; Washington, DC (United States); 28 Aug - 5 sep 1992)			
2	18:538	*See* SAND–92-1820C			
CONF-920893–		(Joint statistical meetings of the American Statistical Association, the Biometric Society and the Institute of Mathematical Statistics; Boston, MA (United States); 9-13 Aug 1992)			
5	18:256	*See* PNL-SA–20520			
CONF-920905–		(10. international symposium on the packaging and transportation of radioactive materials: PATRAM '92; Yokohama (Japan); 13-18 Sep 1992)			
7	18:214	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92040884	MF-513
11	18:1226	*See* SAND–91-2687C			
17	18:1463	*See* SAND–91-2722C			
18	18:1228	*See* SAND–92-1471C			
19	18:1203	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92041254	MF-610
20	18:1204	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92041255	
22	18:215	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92041302	
25	18:1224	*See* SAND–91-2666C			
27	18:1215	*See* LA-UR–92-2961			
29	18:1223	*See* SAND–91-2602C			
32	18:1760	*See* SAND–91-2603C			
35	18:1225	*See* SAND–91-2669C			
CONF-9209108–		(3. annual meeting of USSR Nuclear Society; St. Petersburg (Russian Federation); 14-18 Sep 1992)			
2	18:258	*See* PNL-SA–21009			
CONF-920913–		(14. international conference on plasma physics and controlled nuclear fusion research; Wuerzburg (Germany); 30 Sep - 7 oct 1992)			
4	18:2306	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93001204	MF-420
CONF-9209141–		(19. annual American Society for Quality Control (ASQC) National Energy Division conference; Orlando, FL (United States); 20-23 Sep 1992)			
2	18:301	*See* WSRC-MS–92-278			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-9209142–		(Institute of Electrical and Electronics Engineers (IEEE) international professional communications conference (IPCC): crossing frontiers; Santa Fe, NM (United States); 30 Sep 1992)			
7	18:2487	*See* ANL/CP–76976			
CONF-920916–		(3. international conference and exhibition of the world congress on superconductivity; Munich (Germany); 14-18 Sep 1992)			
1	18:1028	*See* ANL/CP–76326			
CONF-9209160–		(International symposium on energy, environment and information management; Argonne, IL (United States); 15-18 Sep 1992)			
7	18:1473	*See* ANL/CP–77207			
10	18:81	*See* ANL/CP–76147			
12	18:1199	*See* ANL/CP–77468			
14	18:795	*See* ANL/CP–77471			
15	18:782	*See* ANL/CP–77472			
16	18:787	*See* ANL/CP–77467			
18	18:816	*See* ANL/CP–76058			
CONF-9209177–		(Nuclear power engineering in space nuclear rocket engines; Kazakhstan (Russian Federation); 22-26 Sep 1992)			
2	18:539	*See* SAND–92-2049C			
CONF-9209184–		(The International Society for Optical Engineering (SPIE) meeting; Boston, MA (United States); 8-11 Sep 1992)			
3	18:1458	*See* SAND–92-0651C			
4	18:1277	*See* SAND–92-0650C			
CONF-9209186–		(Conference for southern states on waste minimization, pollution prevention and environmental regulations; Biloxi, MS (United States); 22-24 Sep 1992)			
2	18:879	*See* ANL/CP–76897			
CONF-9209188–		(20. international congress on high speed photography and photonics; Victoria (Canada); 25-26 Sep 1992)			
4	18:1441	*See* UCRL-JC–109349			
5	18:1404	*See* EGG–10617-5100			
CONF-9209200–		(8. international conference on ion beam modification of materials; Heidelberg (Germany); 7-11 Sep 1992)			
2	18:1037	OSTI; NTIS; GPO Dep.	E 1.99:	DE92041306	MF-404
3	18:1030	*See* ANL/CP–77183			
4	18:310	*See* ANL/CP–76009			
CONF-9209202–		(International conference on strongly correlated electron systems; Sendai (Japan); 7-11 Sep 1992)			
2	18:1011	*See* LA-UR–92-3130			
CONF-9209203–		(Environmental professionals meeting; Park City, UT (United States); 9-11 Sep 1992)			
1	18:1642	*See* RFP–4553			
CONF-9209204–		(Cray users group meeting; Washington, DC (United States); 14-18 Sep 1992)			
2	18:2479	*See* SAND–92-1872C			
3	18:2480	*See* SAND–92-2040C			
CONF-9209206–		(Symposium of northeastern accelerator personnel (SNEAP); Quebec (Canada); 23-25 Sep 1992)			
2	18:1356	*See* EGG–10617-5116			
CONF-9209207–		(NATO workshop on crystallization of polymers; Mons (Belgium); 6-12 Sep 1992)			
1	18:1086	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92040876	MF-401
CONF-920921–		(6. international symposium on small particles and inorganic clusters; Chicago, IL (United States); 16-22 Sep 1992)			
1	18:952	*See* ANL/CP–76413			
2	18:953	*See* ANL/CP–76999			
4	18:1147	*See* ANL/CP–76412			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-9209215–		(4. AIAA USAF/NASA/OAI symposium on multidisciplinary analysis and optimization; Cleveland, OH (United States); 21-23 Sep 1992)			
1	18:2414	*See* ANL/CP–76898			
CONF-9209216–		(7. national conference on hydrocarbon contaminated soils; Amherst, MA (United States); 21-24 Sep 1992)			
1	18:1549	*See* ANL/CP–76923			
CONF-9209217–		(NATO workshop on numerical methods for partial differential equations and critical parameters; Beaune (France); 25-28 Sep 1992)			
1	18:2194	*See* ANL/CP–77115			
CONF-9209224–		(Specialists' meeting on use of fast breeder reactors for actinide transmutation; Obninsk (Russian Federation); 22-24 Sep 1992)			
1	18:517	*See* ANL/CP–76685			
CONF-9209225–		(International seminar on structural investigation at pulsed neutron sources; Dubna (Russian Federation); 1-4 Sep 1992)			
1	18:1397	*See* ANL/CP–77200			
CONF-9209226–		(Emerging technologies in hazardous waste management; Atlanta, GA (United States); 21-23 Sep 1992)			
1	18:276	*See* WSRC-MS–92-324			
CONF-9209227–		(Symposium on magnetic ultrathin films, multilayers, and surfaces; Lyon (France); 7-10 Sep 1992)			
1	18:1017	*See* LBL–32483			
2	18:954	*See* ANL/CP–77178			
CONF-9209228–		(80. statutory meeting of the International Council for the Exploration of the Sea; Wassermunde (Germany); 24 Sep 1992)			
1	18:1627	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000437	MF-402
CONF-9209231–		(International symposium on exterior insulation and finish systems; Arlington, VA (United States); 21-24 Sep 1992)			
1-Draft	18:833	OSTI; NTIS; GPO Dep.	E 1.99:	DE92041256	MF-350
CONF-9209232–		(14. piezoelectric devices conference; Kansas City, MO (United States); 15-17 Sep 1992)			
1	18:1279	*See* SAND–92-1793C			
CONF-9209234–		(Society of Photo-Optical Instrumentation Engineers (SPIE) conference; Victoria (Canada); 21-25 Sep 1992)			
1	18:1403	*See* EGG–10617-4104			
CONF-9209235–		(ISECOS 92: International Organic Substances Solvent Extraction Conference; Voronezh (Russian Federation); 22-25 Sep 1992)			
	18:222	*See* CEA-CONF–11003			
CONF-9209246–		(National Aeronautics and Space Administration (NASA) workshop on global aerosols and biogeochemistry; Orlando, FL (United States); 1-3 Sep 1992)			
1	18:1535	*See* UCRL-JC–111820			
CONF-920930–		(17. symposium on fusion technology; Rome (Italy); 14-18 Sep 1992)			
3	18:2385	*See* LA-UR–92-2993			
6	18:2380	*See* GA-A–21034			
8	18:2381	*See* GA-A–21035			
10	18:2359	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93001362	MF-419
11	18:2360	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93001361	MF-419
CONF-920933–		(16. world conference of the International Nuclear Target Development Society: nuclear target preparation; Legnaro (Italy); 21-25 Sep 1992)			
1	18:307	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92041258	MF-517
2	18:1338	*See* ANL/CP–76539			
3	18:1812	*See* ANL/CP–76580			
CONF-920938–		(6. international symposium on solar thermal concentrating technologies; Mojacar (Spain); 28 Sep - 2 oct 1992)			
1	18:378	*See* SAND–92-1031C			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-920944–		(6. annual New York State Institute on Superconductivity (NYSIS) conference on superconductivity and applications; Buffalo, NY (United States); 15-17 Sep 1992)			
2	18:728	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000450	MF-220
3	18:737	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000448	MF-364
CONF-920945–		(Workshop on inelastic ion surface collisions; Aussois (France); 14-18 Sep 1992)			
1	18:2162	*See* ANL/CP–77000			
CONF-920951–		(US Department of Energy contractors review meeting on gasification and gas stream cleanup systems; Morgantown, WV (United States); 15-17 Sep 1992)			
2	18:1472	*See* ANL/CP–77170			
CONF-920959–		(9. international symposium on gas flow and chemical lasers; Heraklion (Greece); 21-25 Sep 1992)			
1	18:2387	*See* LA-UR–92-3164			
2	18:1216	*See* LA-UR–92-3074			
CONF-920966–		(10. conference on computing in high energy physics; Annecy (France); 21-25 Sep 1992)			
2	18:1430	*See* LA-UR–92-3150			
CONF-920970–		(3. conference on evolution of microstructure in metals during irradiation; Minett (Canada); 29 Sep - 2 oct 1992)			
	18:959	*See* CEA-CONF–11005			
CONF-920971–		(Microelectronic processing; San Jose, CA (United States); 21-25 Sep 1992)			
1	18:1276	*See* SAND–92-0462C			
CONF-921003–		(International conference on design and safety of advanced nuclear power plants; Tokyo (Japan); 25-28 Oct 1992)			
8	18:615	*See* ANL/CP–74935			
9	18:705	*See* ANL/CP–76320			
CONF-921007–		(20. water reactor safety information meeting; Bethesda, MD (United States); 21-23 Oct 1992)			
1	18:726	*See* SAND–92-2026C			
CONF-9210104–		(7. annual conference of the American Society for Precision Engineering (ASPE); Orlando, FL (United States); 18-23 Oct 1992)			
4	18:1217	*See* LA-UR–92-3182			
CONF-9210110–		(33. Oak Ridge National Laboratory/Department of Energy conference on analytical chemistry in energy technology; Gatlinburg, TN (United States); 6-8 Oct 1992)			
1	18:275	*See* WINCO–11876			
CONF-9210125–		(Microcontamination '92; Santa Barbara, CA (United States); 23-30 Oct 1992)			
2	18:1021	*See* SAND–92-1769C			
CONF-9210152–		(1992 Society of Automotive Engineers (SAE) international fuels and lubricants meeting and exposition; San Francisco, CA (United States); 19-22 Oct 1992)			
2	18:945	OSTI; NTIS; GPO Dep.	E 1.99:	DE92041264	MF-334
CONF-9210161–		(12. international vacuum congress; 8. international conference on solid surfaces; Hague (Netherlands); Hague (Netherlands); 12-16 Oct 1992; 12-16 oct 1992)			
1	18:968	OSTI; NTIS; GPO Dep.	E 1.99:	DE92040881	MF-404
3	18:1150	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000445	MF-404
4	18:1344	*See* BNL–47348			
CONF-9210162–		(12. international vacuum congress; 8. international conference on solid surfaces; Hague (Netherlands); Hague (Netherlands); 12-16 Oct 1992; 12-16 oct 1992)			
1	18:968	*See* CONF-9210161–1			
3	18:1344	*See* BNL–47348			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-9210165--		(9. AIST-NEDO/DOE-PETC joint technical meeting on coal liquifation; San Francisco, CA (United States); 12-15 Oct 1992)			
1	18:52	*See* SAND--92-1989C			
CONF-9210166--		(4. international conference on ultra-wideband, short-pulse electromagnetics; Brooklyn, NY (United States); 8-10 Oct 1992)			
1	18:1278	*See* SAND--92-1171C			
CONF-9210167--		(Aerospace hazardous material management; St. Louis, MO (United States); 27-29 Oct 1992)			
1	18:1456	*See* LA-UR--92-3171			
CONF-9210168--		(1992 American Nuclear Society (ANS) international conference; Chicago, IL (United States); 15-20 Oct 1992)			
1	18:1205	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92041265	MF-902
CONF-9210169--		(3. international masonry conference; London (United Kingdom); 24-31 Oct 1992)			
1	18:1231	*See* Y/EN--4729			
CONF-9210170--		(1992 International Energy Efficiency (IEE) and Demand Site Management (DSM) conference; Toronto (Canada); 20-22 Oct 1992)			
1	18:797	OSTI; NTIS; GPO Dep.	E 1.99:	DE92041253	MF-222
CONF-9210172--		(ISLAR '92: international symposium on laboratory automation and robotics; Boston, MA (United States); 25-28 Oct 1992)			
1	18:1140	*See* KCP--613-4841			
CONF-9210173--		(Nuclear Energy Agency Science Committee (NEANSC) specialists meeting on evaluation and processing of covariance data; Oak Ridge, TN (United States); 7-9 Oct 1992)			
1	18:466	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000452	MF-506; MF-523
CONF-9210176--		(63. shock and vibration symposium; Las Cruces, NM (United States); 27 Oct 1992)			
1	18:870	*See* ANL/CP--77116			
2	18:1470	*See* SAND--92-1425C			
CONF-9210177--		(1992 Institute of Electrical and Electronic Engineers (IEEE) system, man and cybernetics conference; Chicago, IL (United States); 18-21 Oct 1992)			
1	18:1469	*See* ANL/CP--76975			
CONF-921029--		(Annual Department of Energy model conference on waste management and environmental restoration; Oak Ridge, TN (United States); 19-22 Oct 1992)			
5	18:224	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000433	MF-902
6	18:294	*See* ANL/CP--76005			
CONF-921036--		(182. meeting of the Electrochemical Society; Toronto (Canada); 11-16 Oct 1992)			
6	18:1180	*See* BNL--47591			
7	18:741	*See* LBL--32395			
CONF-921037--		(9. annual international Pittsburgh coal conference; Pittsburgh, PA (United States); 12-16 Oct 1992)			
4	18:72	*See* ANL/CP--75598			
5	18:818	*See* DOE/ET/10815--195			
CONF-921038--		(11. international conference on magnetohydrodynamics (MHD) electrical power generation; Beijing (China); 12-16 Oct 1992)			
5	18:817	*See* ANL/CP--77194			
CONF-921046--		(Symposium on nuclear data evaluation methodology; Upton, NY (United States); 12-16 Oct 1992)			
1	18:2004	*See* LA-UR--92-3199			
CONF-921084--		(Conference on object-oriented programming systems, languages, and applications; Vancouver (Canada); 18-22 Oct 1992)			
2	18:2413	*See* ANL/CP--75674			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-921090–		(International symposium on energetic materials technology: demilitarization; New Orleans, LA (United States); 4-7 Oct 1992)			
1	18:264	*See* SAND–92-0685C			
CONF-921102–		(Joint American Nuclear Society (ANS)/European Nuclear Society (ENS) international meeting on fifty years of controlled nuclear chain reaction: past, present, and future; Chicago, IL (United States); 15-20 Nov 1992)			
20	18:1431	*See* LBL–32347			
CONF-921104–		(American Institute of Chemical Engineers annual meeting; Miami, FL (United States); 1-6 Nov 1992)			
5	18:1179	*See* WSRC-MS–92-332			
CONF-921110–		(Winter annual meeting of the American Society of Mechanical Engineers (ASME); Anaheim, CA (United States); 8-13 Nov 1992)			
28	18:1537	*See* Y/ENG/SE–109			
29	18:2097	*See* LBL–32279			
CONF-9211105–		(Maximizing luminosity of hadron colliders at 100 TeV; Erice (Italy); 13-19 Nov 1992)			
1	18:1396	*See* LBL–32537			
CONF-921116–		(12. international conference on the application of accelerators in research and industry; Denton, TX (United States); 2-5 Nov 1992)			
1	18:312	*See* EGG–10617-3012			
2	18:1298	*See* LA-UR–92-3215			
CONF-921129–		(39. national symposium of the American Vacuum Society; Chicago, IL (United States); 9-13 Nov 1992)			
1	18:2386	*See* LA-UR–92-3161			
CONF-921162–		(Hypervelocity impact symposium; Austin, TX (United States); 17-20 Nov 1992)			
6	18:1457	*See* SAND–91-2871C			
9	18:1069	*See* LA-UR–92-3003			
CONF-921188–		(Government microcircuit applications conference: microelectronics in the new world order; Las Vegas, NV (United States); 9-12 Nov 1992)			
1	18:1452	*See* SAND–92-2043C			
CONF-921201–		(36. conference on magnetism and magnetic materials; Houston, TX (United States); 1-4 Dec 1992)			
2	18:1070	*See* LA-UR–92-3022			
CONF-921203–		(Thermal performance of the exterior envelopes of buildings; Clearwater, FL (United States); 7-10 Dec 1992)			
1	18:834	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92019477	MF-350
2	18:835	OSTI; NTIS; GPO Dep.	E 1.99:	DE92019967	MF-350
3	18:836	OSTI; NTIS; GPO Dep.	E 1.99:	DE92040714	MF-350
CONF-921204–		(International electron devices meeting; San Francisco, CA (United States); 6-9 Dec 1992)			
1	18:1282	*See* UCRL-JC–111062			
CONF-921207–		(American Society of Agricultural Engineers alternate energy conference; Nashville, TN (United States); 14-15 Dec 1992)			
1	18:1552	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92040029	MF-247
CONF-921209–		(International Association Mathematics and Computers Simulation (IAMCS) international symposium on mathematical modelling and computer simulation; Bangalore (India); 7-11 Dec 1992)			
1	18:2484	*See* UCRL-JC–110061			
2	18:2485	*See* UCRL-JC–110450			
CONF-921210–		(Symposium for high-performance computing for flight vehicles; Washington, DC (United States); 7-9 Dec 1992)			
1	18:2476	*See* SAND–92-0962C			
2	18:2469	*See* LA-UR–92-1753			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-921217–		(17. annual SPIE international conference on infrared and millimeter wave sources; Pasadena, CA (United States); 14-18 Dec 1992)			
1-Extd.Abst.	18:2307	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92041308	MF-420
CONF-921219–		(1992 winter simulation conference; Arlington, VA (United States); 13-16 Dec 1992)			
1	18:2470	*See* LA-UR–92-2338			
CONF-921221–		(High velocity impact symposium; Austin, TX (United States); Dec 1992)			
1	18:1010	*See* LA-UR–92-1982			
2	18:1214	*See* LA-UR–92-1981			
CONF-921226–		(1992 Institute of Electrical and Electronic Engineers (IEEE) semiconductor interface specialists conference; San Diego, CA (United States); 9-13 Dec 1992)			
1	18:1281	*See* SAND–92-1920C			
2	18:1078	*See* SAND–92-1878C			
3	18:1280	*See* SAND–92-1877C			
CONF-930118–		(Winter meeting of the American Society of Heating, Refrigeration and Air Conditioning Engineers; Chicago, IL (United States); 23-27 Jan 1993)			
2	18:837	OSTI; NTIS; GPO Dep.	E 1.99:	DE92041252	MF-350
CONF-930133–		(73. American Meteorological Society (AMS) annual meeting; Anaheim, CA (United States); 17-22 Jan 1993)			
1	18:1475	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92041023	MF-402
CRN–					
92-15	18:1926	OSTI; NTIS (US Sales Only); INIS		DE93721015	
92-31	18:1402	OSTI; NTIS (US Sales Only); INIS		DE93721014	
CRN-PN–					
91-13	18:1710	OSTI; NTIS (US Sales Only); INIS		DE93720937	
91-24	18:1731	OSTI; NTIS (US Sales Only); INIS		DE93721008	
CRN-VIV–					
101	18:1354	OSTI; NTIS (US Sales Only); INIS		DE93721013	
96	18:1294	OSTI; NTIS (US Sales Only); INIS		DE93721000	
97	18:1351	OSTI; NTIS (US Sales Only); INIS		DE93721010	
98	18:1352	OSTI; NTIS (US Sales Only); INIS		DE93721011	
99	18:1353	OSTI; NTIS (US Sales Only); INIS		DE93721012	
CTH-IEFT-PP–					
1992-06	18:2308	OSTI; NTIS; INIS		DE93606269	
1992-10	18:2309	OSTI; NTIS; INIS		DE93606236	
1992-12	18:2310	OSTI; NTIS; INIS		DE93606270	
CWP–					
118R	18:1775	*See* DOE/ER/14079–19			
119R	18:1776	*See* DOE/ER/14079–20			
DEFU-TR–					
300	18:838	OSTI; NTIS		DE93721474	
302	18:839	OSTI; NTIS		DE93721381	
306	18:840	OSTI; NTIS		DE93721478	
DNA–					
001-90-C-0177	18:753	*See* ANL/RP–76696			
DOE-HMIP-RR–					
92.031	18:226	OSTI; NTIS (US Sales Only); INIS		DE93605934	
DOE/AL/33209–					
T1	18:940	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000644	MF-333
DOE/BC/14403–					
3	18:97	OSTI; NTIS; GPO Dep.	E 1.99:	DE92001072	PC-122
DOE/BC/14483–					
16	18:127	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92040972	MF-122
DOE/BC/14664–					
8	18:100	OSTI; NTIS; GPO Dep.	E 1.99:	DE92041138	MF-122
DOE/BC/14853–					
2	18:128	OSTI; NTIS; GPO Dep.	E 1.99:	DE93002229	MF-122
DOE/BP–					
01830-12	18:1628	OSTI; NTIS; GPO Dep.	E 1.99:	DE92040785	MF-902
1914	18:841	OSTI; NTIS; GPO Dep.	E 1.99:	DE92040930	MF-900
92041322	18:1768	OSTI; NTIS; GPO Dep.	E 1.99:	DE92041322	MF-902
93000392	18:732	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000392	MF-902

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
DOE/BP/07096–					
2	18:1553	OSTI; NTIS: GPO Dep.	E 1.99:	DE92040931	MF-902
DOE/BP/12885–					
1	18:1669	OSTI; NTIS; GPO Dep.	E 1.99:	DE92040084	MF-902
DOE/BP/50301–					
3	18:1629	OSTI; NTIS; GPO Dep.	E 1.99:	DE92040929	MF-902
DOE/CE–					
0362P	18:946	OSTI; NTIS; GPO Dep.	E 1.99:	DE92040587	MF-330; MF-334
DOE/CE/15307–					
T1	18:76	OSTI; NTIS; GPO Dep.	E 1.99:	DE93002802	MF-310
DOE/CE/15482–					
T8	18:101	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000650	MF-310
DOE/CE/15497–					
T2	18:102	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000735	MF-310
DOE/CE/15553–					
T1	18:103	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000914	MF-250
DOE/CE/23810–					
3A	18:1151	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000493	MF-310
3B	18:1087	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000537	MF-366
3C	18:1088	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000538	MF-366
3D	18:1089	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000540	MF-366
3E	18:1090	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000539	MF-366
3F	18:1091	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000541	MF-366
DOE/CE/26616–					
T1	18:899	OSTI; NTIS; GPO Dep.	E 1.99:	DE93002847	MF-350
DOE/CE/50274–					
T1	18:842	OSTI; NTIS; GPO Dep.	E 1.99:	DE92041034	MF-330
DOE/CH/10093–					
123	18:881	OSTI; NTIS; GPO Dep.	E 1.99:	DE92001179	PC-370
DOE/CH/10204–					
T1	18:1092	OSTI; NTIS; GPO Dep.	E 1.99:	DE93001790	MF-231
DOE/CH/10205–					
T2	18:379	OSTI; NTIS; GPO Dep.	E 1.99:	DE93001746	MF-232
T3	18:380	OSTI; NTIS; GPO Dep.	E 1.99:	DE93001745	MF-232
T5	18:381	OSTI; NTIS; GPO Dep.	E 1.99:	DE93003062	MF-232
T6	18:382	OSTI; NTIS; GPO Dep.	E 1.99:	DE93003063	MF-232
DOE/CH/10250–					
T1	18:414	OSTI; NTIS; GPO Dep.	E 1.99:	DE93001395	MF-261
DOE/CH/10253–					
T1	18:415	OSTI; NTIS; GPO Dep.	E 1.99:	DE93002939	MF-261
DOE/DP/50081–					
T1	18:948	OSTI; NTIS; GPO Dep.	E 1.99:	DE92040913	MF-700
DOE/EA–					
0737	18:733	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92040951	MF-630
DOE/EH–					
0283	18:1554	OSTI; NTIS; GPO Dep.	E 1.99:	DE93002602	PC-630
DOE/EH/89150–					
1	18:1732	OSTI; NTIS; GPO Dep.	E 1.99:	DE92040516	MF-407
DOE/EIA–					
0035(92/08)	18:792	OSTI; NTIS; GPO; GPO Dep.	E 1.99:	DE92040852	MF-950
0109(92/09)	18:793	OSTI; NTIS; GPO; GPO Dep.	E 1.99:	DE93000624	MF-950
0130(92/09)	18:146	OSTI; NTIS; GPO; GPO Dep.	E 1.99:	DE93001253	MF-950
0226(92/09)	18:798	OSTI; NTIS; GPO; GPO Dep.	E 1.99:	DE93000833	MF-950
0376(90)	18:799	OSTI; NTIS; INIS; GPO; GPO Dep.	E 1.99:	DE92041347	MF-950
0520(92/09)	18:129	OSTI; NTIS; GPO; GPO Dep.	E 1.99:	DE93000888	MF-950
0543(92/2Q)	18:794	OSTI; NTIS; INIS; GPO; GPO Dep.	E 1.99:	DE92041309	MF-950
DOE/EIS–					
0165-D-Vol.1	18:130	OSTI; NTIS; GPO Dep.	E 1.99:	DE93002186	MF-630
DOE/ER–					
0390	18:1555	OSTI; NTIS; GPO Dep.	E 1.99:	DE92040275	MF-403
0562P	18:321	OSTI; NTIS; GPO Dep.	E 1.99:	DE93001757	MF-408
1070-D1	18:225	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92010909	MF-902
DOE/ER/12115–					
2	18:941	OSTI; NTIS; GPO Dep.	E 1.99:	DE93003068	MF-406
DOE/ER/12809–					
2	18:467	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92040987	MF-400
DOE/ER/12820–					
2	18:1233	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000675	MF-406
DOE/ER/12824–					
2	18:593	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92040991	MF-405; MF-406

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
3	18:594	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92040992	MF-405; MF-406
DOE/ER/12825–					
1	18:969	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92040989	MF-404
2	18:970	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92040988	MF-404
3	18:971	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92040990	MF-404
DOE/ER/12933–					
3	18:1234	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000887	MF-406
DOE/ER/13030–					
2	18:555	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000422	MF-406
DOE/ER/13032–					
T2	18:1235	OSTI; NTIS; GPO Dep.	E 1.99:	DE92040527	MF-406
DOE/ER/13045–					
T1	18:501	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000403	MF-406
DOE/ER/13227–					
T4	18:1183	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000884	MF-401
DOE/ER/13290–					
8	18:1152	OSTI; NTIS; GPO Dep.	E 1.99:	DE92040843	MF-401
DOE/ER/13335–					
1	18:2202	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000404	MF-406
DOE/ER/13377–					
5	18:318	OSTI; NTIS; GPO Dep.	E 1.99:	DE92040971	MF-408
DOE/ER/13394–					
T2	18:2085	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93001849	MF-411
DOE/ER/13404–					
7	18:1186	OSTI; NTIS; GPO Dep.	E 1.99:	DE92040465	MF-401
DOE/ER/13414–					
T1	18:1774	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000931	MF-403
DOE/ER/13433–					
4	18:1093	OSTI; NTIS; GPO Dep.	E 1.99:	DE93003118	MF-404
DOE/ER/13463–					
9	18:1153	OSTI; NTIS; GPO Dep.	E 1.99:	DE93003160	MF-401
DOE/ER/13491–					
577	18:2086	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93001386	MF-411
DOE/ER/13498–					
T3	18:327	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000780	MF-408
DOE/ER/13572–					
1	18:1129	OSTI; NTIS; GPO Dep.	E 1.99:	DE92040894	MF-406
3	18:1201	OSTI; NTIS; GPO Dep.	E 1.99:	DE92040895	MF-406
4	18:1130	OSTI; NTIS; GPO Dep.	E 1.99:	DE92040897	MF-406
DOE/ER/13603–					
6	18:1184	OSTI; NTIS; GPO Dep.	E 1.99:	DE93001681	MF-401
DOE/ER/13613–					
36	18:1131	OSTI; NTIS; GPO Dep.	E 1.99:	DE92040524	MF-401
DOE/ER/13626–					
6	18:1154	OSTI; NTIS; GPO Dep.	E 1.99:	DE92040522	MF-401
DOE/ER/13629–					
6	18:1185	OSTI; NTIS; GPO Dep.	E 1.99:	DE93001841	MF-401
DOE/ER/13659–					
6	18:1132	OSTI; NTIS; GPO Dep.	E 1.99:	DE92040602	MF-401
DOE/ER/13739–					
1	18:322	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000676	MF-408
DOE/ER/13764–					
T3	18:1236	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000647	MF-406
DOE/ER/13815–					
T1	18:2488	OSTI; NTIS; GPO Dep.	E 1.99:	DE93001744	MF-400
DOE/ER/13846–					
5	18:2203	OSTI; NTIS; GPO Dep.	E 1.99:	DE93001837	MF-405
DOE/ER/13878–					
4	18:1200	OSTI; NTIS; GPO Dep.	E 1.99:	DE93002881	MF-401
DOE/ER/13943–					
02	18:1155	OSTI; NTIS; GPO Dep.	E 1.99:	DE93001847	MF-411
DOE/ER/13967–					
T1	18:1670	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000913	MF-408
DOE/ER/14011–					
2	18:328	OSTI; NTIS; GPO Dep.	E 1.99:	DE93003120	MF-408
DOE/ER/14079–					
19	18:1775	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000386	MF-403
20	18:1776	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000640	MF-403
DOE/ER/14080–					
3	18:1156	OSTI; NTIS; GPO Dep.	E 1.99:	DE92040856	MF-401

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DOE/ER/14153–					
2	18:1777	OSTI; NTIS; GPO Dep.	E 1.99:	DE93002097	MF-403
DOE/ER/14161–					
1	18:2074	OSTI; NTIS; GPO Dep.	E 1.99:	DE92040509	MF-411
2	18:1157	OSTI; NTIS; GPO Dep.	E 1.99:	DE93001389	MF-401
DOE/ER/14224–					
1	18:2164	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92040066	MF-411
DOE/ER/40145–					
7	18:1984	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93001798	MF-413
DOE/ER/40153–					
9	18:1843	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93002868	MF-414
DOE/ER/40256–					
7	18:1985	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92040601	MF-414
DOE/ER/40269–					
14	18:2028	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93001614	MF-413
DOE/ER/40316–					
6	18:2029	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92040847	MF-413
DOE/ER/40389–					
75	18:1927	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000406	MF-414
DOE/ER/40408–					
7	18:2030	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000400	MF-414
DOE/ER/40417–					
9	18:1994	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000405	MF-413
DOE/ER/40546–					
1	18:1837	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000305	MF-414
T1	18:1957	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000648	MF-414
T2	18:1899	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000649	MF-414
DOE/ER/40561–					
75	18:1995	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92040074	MF-413
76	18:1844	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92040075	MF-414
DOE/ER/40571–					
T1	18:2031	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93003269	MF-413
DOE/ER/40606–					
2	18:1817	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93002042	MF-414
DOE/ER/40617–					
134	18:1845	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93001858	MF-414
DOE/ER/40619–					
2	18:1996	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93002884	MF-414
DOE/ER/40661–					
1	18:1838	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93001430	MF-414
DOE/ER/40662–					
1	18:1928	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93001495	MF-414
DOE/ER/40669–					
2	18:1295	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93002770	MF-414
DOE/ER/40673–					
1	18:1455	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92019732	MF-414
DOE/ER/40682–					
2	18:1846	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93002417	MF-414
4	18:1847	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93002415	MF-414
6	18:1929	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93002413	MF-414
7	18:1930	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93002412	MF-414
11	18:1848	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93002644	MF-414
12	18:1849	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93002645	MF-414
13	18:1900	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93002646	MF-414
18	18:1818	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93002649	MF-414
DOE/ER/40698–					
1	18:1901	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92041153	MF-414
DOE/ER/45151–					
T1	18:1158	OSTI; NTIS; GPO Dep.	E 1.99:	DE93001701	MF-404
DOE/ER/45183–					
8	18:1355	OSTI; NTIS; GPO Dep.	E 1.99:	DE93002095	MF-404
DOE/ER/45184–					
T1	18:972	OSTI; NTIS; GPO Dep.	E 1.99:	DE93003126	MF-404
DOE/ER/45229–					
27	18:973	OSTI; NTIS; GPO Dep.	E 1.99:	DE92040858	MF-404
DOE/ER/45253–					
7	18:974	OSTI; NTIS; GPO Dep.	E 1.99:	DE93001685	MF-404
DOE/ER/45308–					
6	18:975	OSTI; NTIS; GPO Dep.	E 1.99:	DE92040893	MF-404
DOE/ER/45314–					
5	18:1094	OSTI; NTIS; GPO Dep.	E 1.99:	DE93001749	MF-404

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
DOE/ER/45346–					
T1	18:976	OSTI; NTIS; GPO Dep.	E 1.99:	DE93002879	MF-404
DOE/ER/45372–					
5	18:1038	OSTI; NTIS; GPO Dep.	E 1.99:	DE93003121	MF-404
DOE/ER/45400–					
T4	18:1039	OSTI; NTIS; GPO Dep.	E 1.99:	DE93001726	MF-404
DOE/ER/45414–					
T1	18:977	OSTI; NTIS; GPO Dep.	E 1.99:	DE93002864	MF-401
DOE/ER/45419–					
3	18:1095	OSTI; NTIS; GPO Dep.	E 1.99:	DE93001844	MF-401
DOE/ER/45431–					
2	18:2090	OSTI; NTIS; GPO Dep.	E 1.99:	DE92040855	MF-410
DOE/ER/45445–					
4	18:2101	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93001986	MF-413
DOE/ER/51124–					
7	18:2311	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000886	MF-427
DOE/ER/53198–					
199	18:2312	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000491	MF-426
205	18:2361	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93002736	PC-426
DOE/ER/53225–					
2	18:2313	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93002522	MF-426
T4	18:2314	OSTI; NTIS; GPO Dep.	E 1.99:	DE93002529	MF-420
T7	18:2315	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93002539	MF-420
T8	18:2316	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93002642	MF-420
DOE/ER/53275–					
4	18:2317	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92040891	MF-420
DOE/ER/53296–					
3	18:2318	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000885	MF-421
DOE/ER/54149–					
1	18:2319	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92040510	MF-421
DOE/ER/60245–					
2	18:1476	OSTI; NTIS; GPO Dep.	E 1.99:	DE93001431	MF-402
3	18:1477	OSTI; NTIS; GPO Dep.	E 1.99:	DE93003039	MF-403
4	18:1478	OSTI; NTIS; GPO Dep.	E 1.99:	DE93003040	MF-403
5	18:1479	OSTI; NTIS; GPO Dep.	E 1.99:	DE93003041	MF-403
6	18:1480	OSTI; NTIS; GPO Dep.	E 1.99:	DE93003042	MF-403
T1	18:1556	OSTI; NTIS; GPO Dep.	E 1.99:	DE93001748	MF-402
DOE/ER/60247–					
T3	18:1557	OSTI; NTIS; GPO Dep.	E 1.99:	DE93001747	MF-402
DOE/ER/60253–					
T5	18:1558	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000883	MF-402
DOE/ER/60294–					
T2	18:1481	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93001900	MF-402
T3	18:1482	OSTI; NTIS; GPO Dep.	E 1.99:	DE93003108	MF-402
DOE/ER/60304–					
8	18:1483	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000893	MF-402
DOE/ER/60422–					
7	18:1484	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000898	MF-402
DOE/ER/60434–					
7	18:1678	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92040603	MF-408
DOE/ER/60561–					
7	18:1679	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93002098	MF-408
DOE/ER/60612–					
4	18:1559	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000384	MF-408
DOE/ER/60628–					
3	18:1630	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000897	MF-408
DOE/ER/60636–					
4	18:1671	OSTI; NTIS; GPO Dep.	E 1.99:	DE92041136	MF-408
DOE/ER/60673–					
T5	18:1665	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93002520	MF-408
DOE/ER/60674–					
5	18:1763	OSTI; NTIS; GPO Dep.	E 1.99:	DE93001568	MF-408
DOE/ER/60700–					
5	18:1666	OSTI; NTIS; GPO Dep.	E 1.99:	DE93001387	MF-408
DOE/ER/60715–					
3	18:1560	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000896	MF-402
DOE/ER/60742–					
5	18:1733	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93003122	MF-408
DOE/ER/60842–					
T1	18:1561	OSTI; NTIS; GPO Dep.	E 1.99:	DE93001848	MF-402

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DOE/ER/60912–T1	18:1734	OSTI; NTIS; GPO Dep.	E 1.99:	DE93002866	MF-408
DOE/ER/60946–3	18:1631	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93003159	MF-402
DOE/ER/61057–2	18:1485	OSTI; NTIS; GPO Dep.	E 1.99:	DE93002772	MF-402
DOE/ER/61059–1	18:1486	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000915	MF-402
DOE/ER/61065–2	18:1487	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93001792	MF-402; MF-406
DOE/ER/61104–T1	18:1680	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92040996	MF-408
DOE/ER/61136–2	18:1735	OSTI; NTIS; GPO Dep.	E 1.99:	DE93003156	MF-408
DOE/ER/61159–2	18:1562	OSTI; NTIS; GPO Dep.	E 1.99:	DE93001846	MF-408
DOE/ER/61162–1	18:1672	OSTI; NTIS; GPO Dep.	E 1.99:	DE93002732	MF-408
DOE/ER/61223–1	18:1632	OSTI; NTIS; GPO Dep.	E 1.99:	DE92040508	MF-402
DOE/ER/61224–1	18:1633	OSTI; NTIS; GPO Dep.	E 1.99:	DE92040517	MF-402
DOE/ER/61230–1	18:1673	OSTI; NTIS; GPO Dep.	E 1.99:	DE92040626	MF-408
DOE/ER/61232–2	18:1674	OSTI; NTIS; GPO Dep.	E 1.99:	DE93003066	MF-408
DOE/ER/61361–1	18:1488	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000424	MF-402
DOE/ER/75419–T1	18:104	OSTI; NTIS; GPO Dep.	E 1.99:	DE93002880	MF-400; MF-406
DOE/ER/75650–1	18:743	OSTI; NTIS; GPO Dep.	E 1.99:	DE93003044	MF-400
DOE/ER/75658–1	18:744	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000425	MF-400
DOE/ER/75660–1	18:745	OSTI; NTIS; GPO Dep.	E 1.99:	DE92041115	MF-400
DOE/ER/75663–1	18:746	OSTI; NTIS; GPO Dep.	E 1.99:	DE92041117	MF-400
DOE/ER/75681–1	18:747	OSTI; NTIS; GPO Dep.	E 1.99:	DE92041116	MF-400
DOE/ER/75682–1	18:774	OSTI; NTIS; GPO Dep.	E 1.99:	DE93001484	MF-400
1-Pt.4	18:748	OSTI; NTIS; GPO Dep.	E 1.99:	DE93001488	MF-400
DOE/ET/10815–195	18:818	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000786	MF-112
DOE/ET/29239–T1	18:1272	OSTI; NTIS; GPO Dep.	E 1.99:	DE92019747	MF-221
DOE/ET/53088–563	18:2320	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000498	MF-420
564	18:2321	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000407	MF-420
566	18:2322	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93001851	MF-420
567	18:2323	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000622	MF-427
568	18:2324	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000623	MF-427
570	18:2325	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000880	MF-427
573	18:2326	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93001852	MF-420
575	18:2327	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93001853	MF-420
DOE/FE–0265P	18:428	OSTI; NTIS; GPO Dep.	E 1.99:	DE93001756	PC-101
DOE/ID/12624–2	18:882	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000907	PC-310
DOE/ID/12692–3	18:1096	OSTI; NTIS; GPO Dep.	E 1.99:	DE93001352	PC-310
DOE/ID/12735–T24	18:819	OSTI; NTIS; GPO Dep.	E 1.99:	DE93001854	MF-112
DOE/ID/12839–8	18:98	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000517	MF-122
DOE/ID/12949–T1	18:1040	OSTI; NTIS; GPO Dep.	E 1.99:	DE92019333	PC-310

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
DOE/ID/13040–					
T11	18:403	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000387	MF-257
DOE/MC/11089–					
3094-Vol.3	18:150	OSTI; NTIS; GPO Dep.	E 1.99:	DE92001285	PC-123
3107	18:151	OSTI; NTIS; GPO Dep.	E 1.99:	DE92041343	MF-123
3108	18:152	OSTI; NTIS; GPO Dep.	E 1.99:	DE92041344	MF-123
DOE/MC/22194–					
3001	18:823	OSTI; NTIS; GPO Dep.	E 1.99:	DE91002082	PC-110
DOE/MC/23270–					
3105	18:824	OSTI; NTIS; GPO Dep.	E 1.99:	DE92001300	PC-110
DOE/MC/24120–					
3121	18:139	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000201	PC-132
DOE/MC/24207–					
2994	18:22	OSTI; NTIS; GPO Dep.	E 1.99:	DE91002075	MF-103
2995	18:2420	OSTI; NTIS; GPO Dep.	E 1.99:	DE91002076	MF-103
2996	18:82	OSTI; NTIS; GPO Dep.	E 1.99:	DE91002077	MF-103
DOE/MC/24216–					
3122	18:83	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000202	PC-103
DOE/MC/24223–					
3103	18:825	OSTI; NTIS; GPO Dep.	E 1.99:	DE92001298	PC-110
DOE/MC/25009–					
3123	18:826	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000203	PC-110
DOE/MC/25020–					
3129	18:23	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000214	MF-109
DOE/MC/25026–					
3106	18:827	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012451	PC-110
DOE/MC/26024–					
3109	18:140	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012452	PC-132
DOE/MC/26233–					
2935	18:24	OSTI; NTIS; GPO Dep.	E 1.99:	DE91002019	MF-106
DOE/MC/26366–					
2979	18:25	OSTI; NTIS; GPO Dep.	E 1.99:	DE91002059	MF-109
DOE/MC/27260–					
92/C0043	18:141	OSTI; NTIS; GPO Dep.	E 1.99:	DE93001426	MF-132
DOE/MC/27394–					
92/C0047	18:828	OSTI; NTIS; GPO Dep.	E 1.99:	DE92040939	MF-110
DOE/MC/28080–					
92/C0066	18:142	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000398	MF-132
DOE/MC/28239–					
92/C0067	18:143	OSTI; NTIS; GPO Dep.	E 1.99:	DE93001427	MF-132
DOE/NV/10384–					
13	18:227	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93002867	MF-703; MF-721
DOE/NV/10412–					
3	18:105	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000934	MF-251
DOE/NV/10425–					
T12	18:399	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93002865	MF-255
DOE/NV/10630–					
33-Vol.1	18:1489	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93002977	MF-702
33-Vol.2	18:1490	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93002978	MF-702
DOE/NV/10645–					
14	18:295	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000385	MF-702
DOE/OR–					
1054-D1	18:228	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92041271	MF-902
1060-D1	18:296	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92041220	MF-902
DOE/OR/00033–					
T485	18:1237	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92041033	MF-402
T486	18:1736	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92041036	MF-408
DOE/OR/21949–					
341	18:297	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93001267	MF-902
DOE/PC/79672–					
T3	18:820	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000904	MF-112
DOE/PC/79892–					
T21	18:2	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000478	PC-102
DOE/PC/79901–					
T5	18:55	OSTI; NTIS; GPO Dep.	E 1.99:	DE92041110	MF-104
T7	18:56	OSTI; NTIS; GPO Dep.	E 1.99:	DE92041112	MF-104
DOE/PC/79903–					
T15	18:57	OSTI; NTIS; GPO Dep.	E 1.99:	DE93001869	MF-105
T17	18:58	OSTI; NTIS; GPO Dep.	E 1.99:	DE93001870	MF-105
T18	18:1238	OSTI; NTIS; GPO Dep.	E 1.99:	DE93001871	MF-105

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
DOE/PC/81004–					
T4	18:73	OSTI; NTIS; GPO Dep.	E 1.99:	DE92041292	MF-105
DOE/PC/89652–					
T7	18:429	OSTI; NTIS; GPO Dep.	E 1.99:	DE92041250	MF-105
DOE/PC/89757–					
9	18:59	OSTI; NTIS; GPO Dep.	E 1.99:	DE92040015	MF-102
DOE/PC/89766–					
T8	18:3	OSTI; NTIS; GPO Dep.	E 1.99:	DE92040533	MF-102
DOE/PC/89769–					
T12	18:84	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000938	MF-103
DOE/PC/89869–					
T7	18:26	OSTI; NTIS; GPO Dep.	E 1.99:	DE92041239	MF-108
T8	18:27	OSTI; NTIS; GPO Dep.	E 1.99:	DE92041283	MF-108
DOE/PC/89883–					
45	18:28	OSTI; NTIS; GPO Dep.	E 1.99:	DE92041236	PC-108
47	18:29	OSTI; NTIS; GPO Dep.	E 1.99:	DE92041235	PC-108
DOE/PC/90055–					
T5	18:30	OSTI; NTIS; GPO Dep.	E 1.99:	DE92041282	MF-108
DOE/PC/90169–					
T5	18:85	OSTI; NTIS; GPO Dep.	E 1.99:	DE92041280	MF-105
DOE/PC/90174–					
T5	18:4	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000484	PC-102
DOE/PC/90274–					
T19	18:821	OSTI; NTIS; GPO Dep.	E 1.99:	DE92041285	MF-112
T20	18:822	OSTI; NTIS; GPO Dep.	E 1.99:	DE92041284	MF-112
DOE/PC/90284–					
7	18:60	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000900	MF-113
DOE/PC/90289–					
T6	18:31	OSTI; NTIS; GPO Dep.	E 1.99:	DE92040772	MF-109
DOE/PC/90292–					
T5	18:430	OSTI; NTIS; GPO Dep.	E 1.99:	DE92041248	MF-105
T6	18:1159	OSTI; NTIS; GPO Dep.	E 1.99:	DE92041247	MF-105
DOE/PC/90305–					
T8	18:32	OSTI; NTIS; GPO Dep.	E 1.99:	DE93001274	MF-113
DOE/PC/90310–					
T7	18:86	OSTI; NTIS; GPO Dep.	E 1.99:	DE92040773	MF-113
DOE/PC/90361–					
T7	18:431	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000645	MF-105
DOE/PC/90365–					
T7	18:432	OSTI; NTIS; GPO Dep.	E 1.99:	DE92040539	MF-105
DOE/PC/90505–					
T9	18:433	OSTI; NTIS; GPO Dep.	E 1.99:	DE92040421	PC-104
DOE/PC/90751–					
T14	18:61	OSTI; NTIS; GPO Dep.	E 1.99:	DE92040531	MF-104
DOE/PC/91040–					
T3	18:33	OSTI; NTIS; GPO Dep.	E 1.99:	DE92041281	MF-108
DOE/PC/91041–					
T1	18:34	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000302	MF-108
T2	18:35	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000731	MF-108
T3	18:36	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000732	MF-108
DOE/PC/91043–					
T3	18:37	OSTI; NTIS; GPO Dep.	E 1.99:	DE92040540	MF-108
DOE/PC/91058–					
T1	18:38	OSTI; NTIS; GPO Dep.	E 1.99:	DE92040904	MF-108
T2	18:39	OSTI; NTIS; GPO Dep.	E 1.99:	DE92040905	MF-108
DOE/PC/91154–					
T2	18:425	OSTI; NTIS; GPO Dep.	E 1.99:	DE92041249	MF-104
DOE/PC/91161–					
T1	18:87	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000306	MF-104
DOE/PC/91283–					
T2	18:5	OSTI; NTIS; GPO Dep.	E 1.99:	DE92040537	MF-102
DOE/PC/91284–					
T1	18:434	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000916	MF-117
DOE/PC/91286–					
T3	18:40	OSTI; NTIS; GPO Dep.	E 1.99:	DE92041240	MF-109
DOE/PC/91290–					
T3	18:6	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000736	MF-102
DOE/PC/91297–					
4	18:1239	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000722	MF-117
DOE/PC/91306–					
3	18:435	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000518	MF-105

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
DOE/PC/91309–					
T5	18:1041	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000902	MF-114
DOE/PC/91334–					
T100	18:94	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000942	MF-113
T101	18:48	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000941	MF-106
T102	18:49	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000940	MF-105
T69	18:7	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000519	MF-102
T71	18:41	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000521	MF-102
T73	18:8	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000522	MF-102
T74	18:42	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000523	MF-102
T75	18:43	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000524	MF-102
T76	18:88	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000525	MF-104
T77	18:62	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000526	MF-113
T78	18:89	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000527	MF-104
T79	18:90	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000528	MF-105
T80	18:91	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000529	MF-113
T81	18:63	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000530	MF-113
T82	18:64	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000531	MF-113
T83	18:65	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000532	MF-102
T84	18:9	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000533	MF-102
T85	18:44	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000534	MF-102
T86	18:66	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000535	MF-102
T87	18:67	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000536	MF-102
T88	18:45	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000958	MF-108
T92	18:68	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000951	MF-113
T95	18:46	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000948	MF-109
T96	18:92	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000947	MF-105
T97	18:74	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000945	MF-113
T98	18:93	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000944	MF-113; MF-105
T99	18:47	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000943	MF-109
DOE/PC/91344–					
T1	18:436	OSTI; NTIS; GPO Dep.	E 1.99:	DE92040519	MF-105
DOE/PE–					
0105P	18:1491	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000477	MF-902
DOE/RA/50219–					
41	18:1769	OSTI; NTIS; GPO Dep.	E 1.99:	DE93003124	MF-220
DOE/RL–					
90-48	18:229	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93001475	MF-630
DOE/RW–					
0361-SR	18:230	OSTI (Free of Charge); INIS		TI93002389	MF-800
0362-SR	18:1737	OSTI (Free of Charge); INIS		TI93002388	MF-800
0369	18:231	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92041118	MF-802
0371P	18:232	OSTI (Free of Charge); INIS		TI93002409	MF-812
DOE/SF/16345–					
5	18:384	OSTI; NTIS; GPO Dep.	E 1.99:	DE92040999	MF-231
DPSP–					
58-814	18:616	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92040821	MF-701
61-1841	18:617	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000488	MF-706
61-2291	18:618	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93000471	MF-704
64-2079	18:619	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92040820	MF-706
75-1219	18:620	OSTI; NTIS; GPO Dep.	E 1.99:	DE93001355	MF-704
DPST–					
86-278	18:281	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000520	MF-702
DPW–					
3122	18:173	*See* GEH–18818			
5110	18:595	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92040432	MF-700
5331	18:1133	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93001242	MF-700
5333	18:596	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93001243	MF-700
5360	18:193	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93001244	MF-700
5373	18:194	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93001246	MF-700
5380	18:195	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93001247	MF-700
5392	18:706	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93001455	MF-700
5408	18:621	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93001456	MF-706
5410	18:707	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93001457	MF-700
5411	18:1206	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93001458	MF-700
5412	18:622	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93001459	MF-700
5420	18:978	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93001460	MF-700
5423	18:585	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93001461	MF-700
5475	18:623	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93001905	MF-700
5490	18:624	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93001911	MF-700

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
5520	18:1207	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93001913	MF-700
5570	18:165	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93001915	MF-700
5601	18:625	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93000659	MF-704
5615	18:166	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93000660	MF-700
5666	18:626	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93000661	MF-700
5690	18:196	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93000662	MF-700
5715	18:627	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93000664	MF-700
5716	18:167	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93000665	MF-700
5717	18:168	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93000666	MF-700
5718	18:169	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93000667	MF-700
5863	18:170	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93001235	MF-700
5864	18:197	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93001236	MF-700
5911	18:979	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93001238	MF-700
5912	18:586	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93001239	MF-700
5915	18:171	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93001240	MF-700
5921	18:172	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93001241	MF-700
6618	18:198	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93000658	MF-700
871	18:502	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92040836	MF-706
DTH-AFM–					
91-04	18:1240	OSTI; NTIS		DE93721475	
DTH-LA–					
41	18:438	OSTI; NTIS; INIS		DE93721473	
DTH-LET-RE–					
92-1	18:942	OSTI; NTIS		DE93721476	
DTH-LV–					
233	18:843	OSTI; NTIS		DE93721406	
DTP–					
92/16.	18:1954	*See* RAL–92-021			
DUN–					
1008	18:282	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93000317	MF-502
5030	18:283	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93000318	MF-502
5563	18:284	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93000319	MF-502
ECN-C–					
91-066	18:1563	OSTI; NTIS; INIS		DE93603572	
92-043	18:50	OSTI; NTIS (US Sales Only)		DE92557284	
92-048	18:409	OSTI; NTIS (US Sales Only); INIS		DE92557320	
ECN-I–					
92-028	18:416	OSTI; NTIS (US Sales Only)		DE92557289	
92-029	18:417	OSTI; NTIS (US Sales Only)		DE92557290	
ECN-RX–					
91-057	18:597	OSTI; NTIS; INIS		DE93603833	
91-074	18:2362	OSTI; NTIS; INIS		DE93604740	
EDF-DER-RA–					
1991-2	18:2402	OSTI; NTIS (US Sales Only); INIS		DE93721226	
EGG–					
10617-1151	18:1492	OSTI; NTIS (documentation only); ESTSC (complete software package), P.O. Box 1020, Oak Ridge, TN 37831-1020; GPO Dep.	E 1.99:	DE93000953	MF-902
10617-2129	18:734	OSTI; NTIS; GPO Dep.	E 1.99:	DE92040480	MF-600
10617-3012	18:312	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000691	MF-706
10617-4104	18:1403	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000692	MF-706
10617-5100	18:1404	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000694	MF-706
10617-5116	18:1356	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000693	MF-706
2571	18:584	*See* NUREG/CR–5416			
2657-Vol.1	18:719	*See* NUREG/CR–5787-Vol.1			
2657-Vol.2	18:720	*See* NUREG/CR–5787-Vol.2			
EGG-M–					
92184	18:1029	*See* ANL/CP–77169			
EGG-TMI–					
7757	18:708	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92040953	MF-523
EHD-TR–					
152	18:1738	OSTI; NTIS (US Sales Only); INIS		DE93603693	
EMO–					
1028-Vol.8	18:1564	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92040804	
1028-Vol.9	18:1565	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92040805	
ENEL-CRTN-G11–					
91-11	18:980	OSTI; NTIS (US Sales Only); INIS		DE93729476	
ENEL-CRTN-T6–					
91-15	18:426	OSTI; NTIS (US Sales Only)		DE93729438	
ES/CSET–					
15	18:299	OSTI; NTIS; GPO Dep.	E 1.99:	DE92040753	MF-407

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
3/R1	18:298	OSTI; NTIS; GPO Dep.	E 1.99:	DE92040754	MF-407
ES/ER–					
43-D1	18:296	*See* DOE/OR–1060-D1			
ESG–					
168	18:1324	*See* LBL–31848			
178	18:1299	*See* LBL–32250			
182	18:1325	*See* LBL–32222-Exc.			
194	18:1385	*See* LBL–32468			
195	18:1382	*See* LBL–32446			
197	18:1384	*See* LBL–32463			
201	18:1326	*See* LBL–32516			
205	18:1327	*See* LBL–32561			
207	18:1329	*See* LBL–32581			
208	18:1328	*See* LBL–32580			
ESTSC–					
000434IBMPC00	18:2421	ESTSC			
000440CY00000	18:2422	ESTSC			
000440IBMPC00	18:2423	ESTSC			
000440MNFRM00	18:2424	ESTSC			
000460IPCAT00	18:2425	ESTSC			
000461AL00000	18:2426	ESTSC			
000461D0VAX00	18:2427	ESTSC			
000507C660000	18:2428	RADIATION SHIELDING INFORMATION CENTER			
000508U110000	18:2429	RADIATION SHIELDING INFORMATION CENTER			
000509C007400	18:2430	ESTSC			
000510I036000	18:2431	RADIATION SHIELDING INFORMATION CENTER			
000511I036000	18:2432	RADIATION SHIELDING INFORMATION CENTER			
000512I036000	18:2433	RADIATION SHIELDING INFORMATION CENTER			
000516C017600	18:2434	RADIATION SHIELDING INFORMATION CENTER			
000517D078000	18:2435	RADIATION SHIELDING INFORMATION CENTER			
000518U110800	18:2436	RADIATION SHIELDING INFORMATION CENTER			
000519IPCAT00	18:2437	RADIATION SHIELDING INFORMATION CENTER			
000520I036000	18:2438	RADIATION SHIELDING INFORMATION CENTER			
000521GE63500	18:2439	RADIATION SHIELDING INFORMATION CENTER			
000522I036000	18:2440	ESTSC			
000522MNFRM00	18:2441	ESTSC			
000523C760000	18:2442	RADIATION SHIELDING INFORMATION CENTER			
000524D078000	18:2443	RADIATION SHIELDING INFORMATION CENTER			
000525IBMPC00	18:2444	ESTSC			
000528C660000	18:2445	RADIATION SHIELDING INFORMATION CENTER			
000531C760000	18:2446	ESTSC			
000533C018000	18:2447	ESTSC			
000533DVX1100	18:2448	ESTSC			
000533I309000	18:2449	ESTSC			
000534MNFRM00	18:2450	ESTSC			
ESTSC/NRC–					
000092I303300	18:2451	ESTSC			
ETDE-IT–					
92-76	18:405	OSTI; NTIS (US Sales Only)		DE93729397	
92-78	18:727	OSTI; NTIS (US Sales Only)		DE93729407	
92-80	18:1208	OSTI; NTIS (US Sales Only)		DE93729441	
92-81	18:418	OSTI; NTIS (US Sales Only)		DE93729442	
92-82	18:729	OSTI; NTIS (US Sales Only)		DE93729443	
92-84	18:1634	OSTI; NTIS (US Sales Only); INIS		DE93729445	
92-86	18:1493	OSTI; NTIS (US Sales Only); INIS		DE93729446	
92-88	18:1494	OSTI; NTIS (US Sales Only)		DE93729448	
92-89	18:374	OSTI; NTIS (US Sales Only); INIS		DE93729449	

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
92-90	18:1635	OSTI; NTIS (US Sales Only); INIS		DE93729478	
92-92	18:730	OSTI; NTIS (US Sales Only)		DE93729459	
92-95	18:364	OSTI; NTIS (US Sales Only)		DE93729464	
ETDE/JP-mf–					
93723855	18:77	OSTI; NTIS		DE93723855	
93723856	18:78	OSTI; NTIS		DE93723856	
93723857	18:96	OSTI; NTIS		DE93723857	
EUR–					
12832	18:1667	OSTI; NTIS (US Sales Only)		TI93721229	
13026	18:329	OSTI; NTIS (US Sales Only)		TI93721231	
13089	18:883	OSTI; NTIS (US Sales Only)		TI93721249	
13369	18:1495	OSTI; NTIS (US Sales Only)		TI93706776	
13469	18:385	OSTI; NTIS (US Sales Only)		TI93721345	
13518	18:390	OSTI; NTIS (US Sales Only)		TI93721349	
13647/III	18:2403	OSTI; NTIS (US Sales Only); INIS		TI93720867	
13699	18:147	OSTI; NTIS (US Sales Only)		TI93721344	
13798	18:233	OSTI; NTIS (US Sales Only); INIS		TI93721036	
13837	18:410	OSTI; NTIS (US Sales Only); INIS		TI93720834	
13897	18:369	OSTI; NTIS (US Sales Only)		TI93721346	
13906	18:443	OSTI; NTIS (US Sales Only); INIS		TI93721164	
13907	18:386	OSTI; NTIS (US Sales Only)		TI93721347	
13926	18:144	OSTI; NTIS (US Sales Only)		TI93721348	
13985	18:234	OSTI; NTIS (US Sales Only); INIS		TI93720917	
14017/1	18:330	OSTI; NTIS (US Sales Only)		TI93721256	
14020	18:884	OSTI; NTIS (US Sales Only)		TI93721288	
14023	18:519	OSTI; NTIS (US Sales Only); INIS		TI93721219	
14028	18:2363	OSTI; NTIS (US Sales Only); INIS		TI93721220	
14037	18:444	OSTI; NTIS (US Sales Only); INIS		TI93721221	
14038	18:375	OSTI; NTIS (US Sales Only)		TI93721343	
14039	18:445	OSTI; NTIS (US Sales Only); INIS		TI93721166	
14088	18:1471	OSTI; NTIS (US Sales Only); INIS		TI93721228	
14093	18:235	OSTI; NTIS (US Sales Only); INIS		TI93720918	
14097	18:236	OSTI; NTIS (US Sales Only); INIS		TI93720919	
14136	18:885	OSTI; NTIS (US Sales Only)		TI93721287	
14154	18:237	OSTI; NTIS (US Sales Only); INIS		TI93720920	
14156	18:238	OSTI; NTIS (US Sales Only); INIS		TI93720921	
14159	18:457	OSTI; NTIS (US Sales Only); INIS		TI93721222	
14230	18:458	OSTI; NTIS (US Sales Only); INIS		TI93721227	
14236	18:131	OSTI; NTIS (US Sales Only); INIS		TI93721694	
14254	18:886	OSTI; NTIS (US Sales Only)		TI93721257	
14330	18:354	OSTI; NTIS (US Sales Only); INIS		TI93720899	
14363	18:1209	OSTI; NTIS (US Sales Only); INIS		TI93721081	
14434/1	18:2364	OSTI; NTIS (US Sales Only); INIS		TI93721064	
14434/2	18:2365	OSTI; NTIS (US Sales Only); INIS		TI93721065	
EUR-CEA-FC–					
1447	18:2366	OSTI; NTIS (US Sales Only); INIS		TI93721136	
1451	18:2367	OSTI; NTIS (US Sales Only); INIS		TI93721135	
1452	18:2368	OSTI; NTIS (US Sales Only); INIS		TI93721134	
1453	18:2328	OSTI; NTIS (US Sales Only); INIS		TI93721133	
1455	18:2369	OSTI; NTIS (US Sales Only); INIS		TI93721132	
1456	18:2370	OSTI; NTIS (US Sales Only); INIS		TI93721122	
FCR–					
11486	18:824	*See* DOE/MC/23270–3105			
FEI–					
2037	18:1241	OSTI; NTIS (US Sales Only); INIS		DE93605662	
2080	18:2057	OSTI; NTIS (US Sales Only); INIS		DE93606179	
FEMP/SUB–					
055	18:1636	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93001261	MF-702
FNAL/C–					
92/102	18:1359	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000621	MF-414
92/219	18:1315	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000763	MF-414
92/232	18:1931	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000762	MF-414
92/95	18:1357	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000620	MF-414
92/97	18:1358	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000619	MF-414
FRCEA-TH–					
365	18:2329	OSTI; NTIS (US Sales Only); INIS		DE93721057	
366	18:520	OSTI; NTIS (US Sales Only); INIS		DE93721225	
367	18:1042	OSTI; NTIS (US Sales Only); INIS		DE93720892	
368	18:1097	OSTI; NTIS (US Sales Only); INIS		DE93721140	
369	18:1134	OSTI; NTIS (US Sales Only); INIS		DE93721139	
370	18:1187	OSTI; NTIS (US Sales Only); INIS		DE93721138	

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371	18:1191	OSTI; NTIS (US Sales Only); INIS		DE93721137	
372	18:2379	OSTI; NTIS (US Sales Only); INIS		DE93721708	
FRNC-TH–					
3720	18:1043	OSTI; NTIS (US Sales Only); INIS		DE93721058	
3721	18:149	OSTI; NTIS (US Sales Only)		DE93721352	
GA-A–					
21003	18:2330	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93001359	MF-421
21034	18:2380	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000878	MF-421
21035	18:2381	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93001356	MF-423
GANIL-A–					
92-02	18:2032	OSTI; NTIS (US Sales Only); INIS		DE93721017	
GANIL-R–					
92-07	18:1405	OSTI; NTIS (US Sales Only); INIS		DE93721003	
GANIL-RA–					
89-91	18:1986	OSTI; NTIS (US Sales Only); INIS		DE93720999	
GB–					
452	18:439	OSTI; NTIS (US Sales Only); INIS		DE93722379	
461	18:2394	OSTI; NTIS (US Sales Only)		DE93727502	
462	18:735	OSTI; NTIS (US Sales Only); INIS		DE93729521	
GEH–					
18818	18:173	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93000321	MF-500
GESAMP–					
48	18:756	OSTI; NTIS (US Sales Only); INIS		DE93605636	
GMA–					
1.	18:1746	*See* INFO–0402			
GTK-TURVE–					
217	18:75	OSTI; NTIS		DE93721515	
HCTP–					
04L	18:1126	*See* Y/EN–4595			
3-R1	18:1230	*See* Y/EN–4593			
HW–					
11374	18:629	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93000330	MF-520
20250	18:630	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93002065	MF-520
21761	18:631	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93002070	MF-520
22109	18:632	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93002071	MF-520
22110	18:633	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93002073	MF-520
22423	18:634	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93002072	MF-520
25742	18:709	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93002078	MF-520
28778	18:635	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93000331	MF-500
29406	18:636	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93000332	MF-500
33999	18:710	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93001732	MF-600
34253	18:201	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93001248	MF-711
34329	18:711	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93001734	MF-600
36063	18:712	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93001736	MF-600
36546	18:713	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93001737	MF-600
43938-Del.	18:637	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93000764	MF-500
50089-Del.	18:202	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93000771	MF-500
51211-Del.	18:203	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93000772	MF-500
51741-Del.	18:638	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93001330	MF-500
52809-Del.	18:639	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92040140	MF-700
53449-Del.	18:204	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93000773	MF-500
53961	18:2395	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93000766	MF-500
54689-Del.	18:640	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93000999	MF-700
54760-Del.	18:641	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93000767	MF-500
55162-Del.	18:2396	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93000768	MF-500
55462	18:642	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93001249	MF-700
55870-Del.	18:643	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93001000	MF-700
59840-Del.	18:644	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93001250	MF-700
59849-Del.	18:205	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93001332	MF-500
60236-Del.	18:206	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93001225	MF-500
60246	18:645	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93001251	MF-500
60327-Del.	18:646	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93000990	MF-520
60559-Del.	18:207	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93001226	MF-510
60915-Del.	18:208	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93001227	MF-500
62184	18:647	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93001318	MF-700
62599	18:648	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93001739	MF-500
63313-Del.	18:209	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93001228	MF-500
63317-Del.	18:649	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93001319	MF-700
63740	18:650	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93000770	MF-500
65165-Del.	18:210	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93001783	MF-500
65459	18:2397	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93001333	MF-500

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66237	18:651	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93001334	MF-500
66271-Del.	18:211	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93001784	MF-500
66970	18:652	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93001252	MF-700
67699	18:653	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93000992	MF-520
68029	18:654	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93000993	MF-520
68320	18:655	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93000994	MF-520
68696	18:656	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93000995	MF-520
69054	18:657	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93000334	MF-520
69441	18:658	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93000335	MF-520
69443	18:212	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93001229	MF-500
7-3486	18:628	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93001233	MF-500
70606	18:659	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93000963	MF-520
70920	18:660	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93000996	MF-520
71216	18:661	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93000336	MF-520
71571	18:662	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93000337	MF-520
71897	18:663	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93000997	MF-520
72857	18:664	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93000338	MF-520
73205	18:665	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93000982	MF-520
73514	18:666	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93001230	MF-500
73532	18:667	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93000984	MF-520
73908	18:668	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93000985	MF-520
74175	18:669	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93000986	MF-520
74506	18:670	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93000987	MF-520
74794	18:671	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93000988	MF-520
75099	18:672	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93000989	MF-520
75683	18:673	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93000876	MF-520
84279	18:714	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93001231	MF-500
HY/SPL-E–					
6/1991	18:844	OSTI; NTIS		DE93711151	
7/1992	18:887	OSTI; NTIS		DE93711152	
IAEA-INFCIRC–					
1(Rev.10)	18:2404	OSTI; NTIS (US Sales Only); INIS		DE93604074	
167(Add.15)	18:2490	OSTI; NTIS (US Sales Only); INIS		DE93606003	
335(Add.6)	18:2491	OSTI; NTIS (US Sales Only); INIS		DE93606004	
336(Add.7).	18:2491	*See* IAEA-INFCIRC–335(Add.6)			
409	18:302	OSTI; NTIS (US Sales Only); INIS		DE93604048	
410	18:947	OSTI; NTIS (US Sales Only); INIS		DE93606007	
IAEA-NDS–					
7(Rev.92/7)	18:2489	OSTI; NTIS (US Sales Only); INIS		DE93604056	
IAEA-R–					
5470-F	18:2058	OSTI; NTIS (US Sales Only); INIS		DE93606183	
IAEA-TECDOC–					
652	18:242	OSTI; NTIS (US Sales Only); INIS		DE93603991	
IAF–					
92-0568	18:538	*See* SAND–92-1820C			
IC–					
92/108	18:1850	OSTI; NTIS (US Sales Only); INIS		DE93604132	
92/117	18:1851	OSTI; NTIS (US Sales Only); INIS		DE93604232	
92/143	18:1785	OSTI; NTIS (US Sales Only); INIS		DE93604081	
92/146	18:1852	OSTI; NTIS (US Sales Only); INIS		DE93604133	
92/147	18:2081	OSTI; NTIS (US Sales Only); INIS		DE93604639	
92/148	18:2082	OSTI; NTIS (US Sales Only); INIS		DE93604640	
92/151	18:2033	OSTI; NTIS (US Sales Only); INIS		DE93604519	
92/153	18:1902	OSTI; NTIS (US Sales Only); INIS		DE93604313	
92/154	18:1853	OSTI; NTIS (US Sales Only); INIS		DE93604134	
92/155	18:1903	OSTI; NTIS (US Sales Only); INIS		DE93604256	
92/156	18:1932	OSTI; NTIS (US Sales Only); INIS		DE93604385	
92/157	18:2331	OSTI; NTIS (US Sales Only); INIS		DE93604671	
92/158	18:1786	OSTI; NTIS (US Sales Only); INIS		DE93604082	
92/159	18:2332	OSTI; NTIS (US Sales Only); INIS		DE93604672	
92/160	18:2091	OSTI; NTIS (US Sales Only); INIS		DE93604742	
92/161	18:1933	OSTI; NTIS (US Sales Only); INIS		DE93604361	
92/162	18:2063	OSTI; NTIS (US Sales Only); INIS		DE93604600	
92/164	18:1904	OSTI; NTIS (US Sales Only); INIS		DE93604257	
92/168	18:2087	OSTI; NTIS (US Sales Only); INIS		DE93606214	
92/169	18:1787	OSTI; NTIS (US Sales Only); INIS		DE93604083	
92/170	18:1718	OSTI; NTIS (US Sales Only); INIS		DE93603677	
92/171	18:1854	OSTI; NTIS (US Sales Only); INIS		DE93606061	
92/172	18:1788	OSTI; NTIS (US Sales Only); INIS		DE93606029	
92/173	18:1855	OSTI; NTIS (US Sales Only); INIS		DE93604135	
92/174	18:1819	OSTI; NTIS (US Sales Only); INIS		DE93604117	

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
92/176	18:2075	OSTI; NTIS (US Sales Only); INIS		DE93606192	
92/177	18:1789	OSTI; NTIS (US Sales Only); INIS		DE93604084	
92/179	18:1856	OSTI; NTIS (US Sales Only); INIS		DE93606062	
92/180	18:1857	OSTI; NTIS (US Sales Only); INIS		DE93604136	
92/184	18:1858	OSTI; NTIS (US Sales Only); INIS		DE93606063	
92/185	18:1934	OSTI; NTIS (US Sales Only); INIS		DE93606111	
92/186	18:1905	OSTI; NTIS (US Sales Only); INIS		DE93606104	
92/187	18:1859	OSTI; NTIS (US Sales Only); INIS		DE93606064	
92/190	18:1860	OSTI; NTIS (US Sales Only); INIS		DE93606065	
92/191	18:2092	OSTI; NTIS (US Sales Only); INIS		DE93606295	
92/192	18:1566	OSTI; NTIS (US Sales Only); INIS		DE93605433	
92/193	18:1906	OSTI; NTIS (US Sales Only); INIS		DE93606092	
92/195	18:1861	OSTI; NTIS (US Sales Only); INIS		DE93606066	
92/196	18:1958	OSTI; NTIS (US Sales Only); INIS		DE93606133	
92/197	18:1098	OSTI; NTIS (US Sales Only); INIS		DE93605371	
92/198	18:1160	OSTI; NTIS (US Sales Only); INIS		DE93605139	
92/58	18:1782	OSTI; NTIS (US Sales Only); INIS		DE93606027	
IFP–					
38544	18:106	OSTI; NTIS (US Sales Only)		DE93721368	
38544A	18:107	OSTI; NTIS (US Sales Only)		DE93721369	
39436	18:112	OSTI; NTIS (US Sales Only)		DE93721296	
39564	18:113	OSTI; NTIS (US Sales Only)		DE93721298	
39657	18:771	OSTI; NTIS (US Sales Only); INIS		DE93720904	
39696	18:114	OSTI; NTIS (US Sales Only)		DE93721297	
39895	18:108	OSTI; NTIS (US Sales Only)		DE93721353	
IFSR–					
563	18:2320	*See* DOE/ET/53088–563			
564	18:2321	*See* DOE/ET/53088–564			
566	18:2322	*See* DOE/ET/53088–566			
567	18:2323	*See* DOE/ET/53088–567			
568	18:2324	*See* DOE/ET/53088–568			
570	18:2325	*See* DOE/ET/53088–570			
573	18:2326	*See* DOE/ET/53088–573			
575	18:2327	*See* DOE/ET/53088–575			
IGC–					
114	18:982	OSTI; NTIS (US Sales Only); INIS		DE93605263	
119	18:983	OSTI; NTIS (US Sales Only); INIS		DE93605280	
120	18:549	OSTI; NTIS (US Sales Only); INIS		DE93605747	
122	18:984	OSTI; NTIS (US Sales Only); INIS		DE93605281	
123	18:1739	OSTI; NTIS (US Sales Only); INIS		DE93605558	
124	18:674	OSTI; NTIS (US Sales Only); INIS		DE93605831	
125	18:1496	OSTI; NTIS (US Sales Only); INIS		DE93605544	
126	18:1192	OSTI; NTIS (US Sales Only); INIS		DE93605214	
127	18:521	OSTI; NTIS (US Sales Only); INIS		DE93605824	
IN2P3–					
92-01	18:1997	OSTI; NTIS (US Sales Only); INIS		DE93720936	
92-02	18:1959	OSTI; NTIS (US Sales Only); INIS		DE93720939	
INFO–					
0234-1	18:506	OSTI; NTIS (US Sales Only); INIS		DE93603881	
0300-2	18:1740	OSTI; NTIS (US Sales Only); INIS		DE93603650	
0315	18:285	OSTI; NTIS (US Sales Only); INIS		DE93603679	
0316	18:564	OSTI; NTIS (US Sales Only); INIS		DE93603807	
0317	18:507	OSTI; NTIS (US Sales Only); INIS		DE93603882	
0318	18:541	OSTI; NTIS (US Sales Only); INIS		DE93604017	
0319	18:508	OSTI; NTIS (US Sales Only); INIS		DE93603883	
0363	18:1741	OSTI; NTIS (US Sales Only); INIS		DE93603663	
0363-1	18:1742	OSTI; NTIS (US Sales Only); INIS		DE93603664	
0364	18:1193	OSTI; NTIS (US Sales Only); INIS		DE93603197	
0365	18:509	OSTI; NTIS (US Sales Only); INIS		DE93603884	
0367	18:510	OSTI; NTIS (US Sales Only); INIS		DE93603885	
0368	18:511	OSTI; NTIS (US Sales Only); INIS		DE93603886	
0370	18:512	OSTI; NTIS (US Sales Only); INIS		DE93603887	
0377	18:1743	OSTI; NTIS (US Sales Only); INIS		DE93605552	
0378	18:1567	OSTI; NTIS (US Sales Only); INIS		DE93603573	
0379	18:985	OSTI; NTIS (US Sales Only); INIS		DE93603259	
0380	18:243	OSTI; NTIS (US Sales Only); INIS		DE93604006	
0386	18:155	OSTI; NTIS (US Sales Only); INIS		DE93603216	
0389	18:1744	OSTI; NTIS (US Sales Only); INIS		DE93603651	
0401	18:1745	OSTI; NTIS (US Sales Only); INIS		DE93603652	
0402	18:1746	OSTI; NTIS (US Sales Only); INIS		DE93605610	
0404	18:513	OSTI; NTIS (US Sales Only); INIS		DE93603888	

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0405	18:1747	OSTI; NTIS (US Sales Only); INIS		DE93603653	
0411	18:1568	OSTI; NTIS (US Sales Only); INIS		DE93603557	
0414	18:598	OSTI; NTIS (US Sales Only); INIS		DE93603834	
0416	18:1748	OSTI; NTIS (US Sales Only); INIS		DE93603654	
0420	18:1749	OSTI; NTIS (US Sales Only); INIS		DE93603665	
0421	18:1750	OSTI; NTIS (US Sales Only); INIS		DE93603686	
210(rev.2)	18:609	OSTI; NTIS (US Sales Only); INIS		DE93603680	
INIS-BR–					
2933	18:2093	OSTI; NTIS (US Sales Only); INIS		DE93604743	
2934	18:1839	OSTI; NTIS (US Sales Only); INIS		DE93604123	
2936	18:1263	OSTI; NTIS (US Sales Only); INIS		DE93603789	
2937	18:316	OSTI; NTIS (US Sales Only); INIS		DE93603763	
2939	18:1682	OSTI; NTIS (US Sales Only); INIS		DE93603710	
2940	18:1569	OSTI; NTIS (US Sales Only); INIS		DE93603543	
2941	18:1570	OSTI; NTIS (US Sales Only); INIS		DE93603544	
2942	18:2405	OSTI; NTIS (US Sales Only); INIS		DE93605069	
INIS-GB–					
446	18:1637	OSTI; NTIS (US Sales Only); INIS		DE93605434	
447	18:286	OSTI; NTIS (US Sales Only); INIS		DE93605593	
INIS-mf–					
13349	18:1781	OSTI; NTIS (US Sales Only); INIS		DE93000811	
13358	18:1783	OSTI; NTIS (US Sales Only); INIS		DE93604079	
13359	18:778	OSTI; NTIS (US Sales Only); INIS		DE93604021	
13360	18:757	OSTI; NTIS (US Sales Only); INIS		DE93603707	
13361	18:2336	OSTI; NTIS (US Sales Only); INIS		DE93606216	
13362	18:801	OSTI; NTIS (US Sales Only); INIS		DE93605634	
13363	18:802	OSTI; NTIS (US Sales Only); INIS		DE93605594	
13364	18:779	OSTI; NTIS (US Sales Only); INIS		DE93605958	
13366	18:441	OSTI; NTIS (US Sales Only); INIS		DE93605772	
13367	18:2492	OSTI; NTIS (US Sales Only); INIS		DE93606005	
13368	18:2406	OSTI; NTIS (US Sales Only); INIS		DE93606018	
13370	18:758	OSTI; NTIS (US Sales Only); INIS		DE93605628	
13371	18:1638	OSTI; NTIS (US Sales Only); INIS		DE93605070	
13372	18:134	OSTI; NTIS (US Sales Only); INIS		DE93605632	
INP–					
1496/PH	18:2464	OSTI; NTIS (US Sales Only); INIS		DE93604068	
1538/PH	18:1795	OSTI; NTIS (US Sales Only); INIS		DE93604090	
INT–					
245/PS	18:2018	OSTI; NTIS (US Sales Only); INIS		DE93604474	
IPNO–					
91-06	18:1360	OSTI; NTIS (US Sales Only); INIS		DE93721029	
91-07	18:1361	OSTI; NTIS (US Sales Only); INIS		DE93721056	
92-02	18:1362	OSTI; NTIS (US Sales Only); INIS		DE93721018	
IPNO-DRE–					
91-27	18:1706	OSTI; NTIS (US Sales Only); INIS		DE93720998	
91-30	18:1816	OSTI; NTIS (US Sales Only); INIS		DE93721030	
IPNO-RA–					
91	18:1988	OSTI; NTIS (US Sales Only); INIS		DE93721019	
IPNO-T–					
91-04	18:2019	OSTI; NTIS (US Sales Only); INIS		DE93721031	
91-05	18:1363	OSTI; NTIS (US Sales Only); INIS		DE93721032	
91-06	18:2020	OSTI; NTIS (US Sales Only); INIS		DE93721701	
91-07	18:1999	OSTI; NTIS (US Sales Only); INIS		DE93721700	
92-01	18:2000	OSTI; NTIS (US Sales Only); INIS		DE93721023	
IS-T–					
1571	18:1064	OSTI; NTIS; GPO Dep.	E 1.99:	DE93001217	MF-404
1585	18:1111	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93001221	MF-410
1607	18:1168	OSTI; NTIS; GPO Dep.	E 1.99:	DE93001222	MF-401; MF-404
1613	18:1065	OSTI; NTIS; GPO Dep.	E 1.99:	DE93001223	MF-406
1620	18:1169	OSTI; NTIS; GPO Dep.	E 1.99:	DE93001224	MF-401
1629	18:1668	OSTI; NTIS; GPO Dep.	E 1.99:	DE93001220	MF-401
1630	18:1138	OSTI; NTIS; GPO Dep.	E 1.99:	DE93001219	MF-401
ISN–					
92-31	18:2039	OSTI; NTIS (US Sales Only); INIS		DE93721025	
ITER-IL-FC–					
2.9-0-76.	18:2356	*See* CFFTP-G–9091			
9.2-0-31.	18:2355	*See* CFFTP-G–9028			
9.5.1-0-47.	18:2357	*See* CFFTP-G–9092			
IVO-B–					
01/92	18:1112	OSTI; NTIS		DE93711155	

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02/92	18:1113	OSTI; NTIS		DE93711154	
IYaF–					
90-119	18:1882	OSTI; NTIS (US Sales Only); INIS		DE93606081	
90-123	18:1969	OSTI; NTIS (US Sales Only); INIS		DE93606137	
90-135	18:1391	OSTI; NTIS (US Sales Only); INIS		DE93605731	
90-136	18:1938	OSTI; NTIS (US Sales Only); INIS		DE93606107	
90-138	18:1970	OSTI; NTIS (US Sales Only); INIS		DE93606138	
90-141	18:2382	OSTI; NTIS (US Sales Only); INIS		DE93606291	
90-142	18:1392	OSTI; NTIS (US Sales Only); INIS		DE93605732	
90-147	18:1939	OSTI; NTIS (US Sales Only); INIS		DE93606108	
90-148	18:1364	OSTI; NTIS (US Sales Only); INIS		DE93605716	
91-6	18:1393	OSTI; NTIS (US Sales Only); INIS		DE93605733	
91-8	18:1415	OSTI; NTIS (US Sales Only); INIS		DE93605875	
91-101	18:2221	OSTI; NTIS (US Sales Only); INIS		DE93606387	
91-102	18:2339	OSTI; NTIS (US Sales Only); INIS		DE93606223	
91-105	18:2383	OSTI; NTIS (US Sales Only); INIS		DE93606292	
91-106	18:2340	OSTI; NTIS (US Sales Only); INIS		DE93606224	
91-11	18:1971	OSTI; NTIS (US Sales Only); INIS		DE93606139	
91-111	18:2185	OSTI; NTIS (US Sales Only); INIS		DE93606328	
91-31	18:1883	OSTI; NTIS (US Sales Only); INIS		DE93606082	
91-42	18:1365	OSTI; NTIS (US Sales Only); INIS		DE93605706	
91-58	18:1366	OSTI; NTIS (US Sales Only); INIS		DE93605717	
91-62	18:1830	OSTI; NTIS (US Sales Only); INIS		DE93605452	
91-66	18:2337	OSTI; NTIS (US Sales Only); INIS		DE93606271	
91-67	18:1940	OSTI; NTIS (US Sales Only); INIS		DE93606123	
91-68	18:2338	OSTI; NTIS (US Sales Only); INIS		DE93606218	
91-71	18:1941	OSTI; NTIS (US Sales Only); INIS		DE93606114	
91-76	18:1367	OSTI; NTIS (US Sales Only); INIS		DE93605707	
91-77	18:1394	OSTI; NTIS (US Sales Only); INIS		DE93605734	
91-79	18:1395	OSTI; NTIS (US Sales Only); INIS		DE93605735	
91-83	18:1796	OSTI; NTIS (US Sales Only); INIS		DE93606030	
91-85	18:1316	OSTI; NTIS (US Sales Only); INIS		DE93605693	
91-86	18:1317	OSTI; NTIS (US Sales Only); INIS		DE93605694	
91-97	18:1797	OSTI; NTIS (US Sales Only); INIS		DE93606031	
JINR–					
13-90-16	18:1416	OSTI; NTIS (US Sales Only); INIS		DE93605867	
13-90-236	18:1417	OSTI; NTIS (US Sales Only); INIS		DE93605868	
18-91-435	18:1418	OSTI; NTIS (US Sales Only); INIS		DE93605876	
9-91-457	18:1368	OSTI; NTIS (US Sales Only); INIS		DE93605709	
JINR-D–					
2-91-436	18:1798	OSTI; NTIS (US Sales Only); INIS		DE93606032	
JINR-E–					
1-90-591	18:2001	OSTI; NTIS (US Sales Only); INIS		DE93606143	
1-91-511	18:2040	OSTI; NTIS (US Sales Only); INIS		DE93606160	
10-91-161	18:1419	OSTI; NTIS (US Sales Only); INIS		DE93605861	
10-91-361	18:1420	OSTI; NTIS (US Sales Only); INIS		DE93605862	
10-91-434	18:2466	OSTI; NTIS (US Sales Only); INIS		DE93606013	
11-90-599	18:2159	OSTI; NTIS (US Sales Only); INIS		DE93606303	
11-91-352	18:1895	OSTI; NTIS (US Sales Only); INIS		DE93606067	
13-90-233	18:702	OSTI; NTIS (US Sales Only); INIS		DE93605832	
14-90-365	18:2223	OSTI; NTIS (US Sales Only); INIS		DE93606389	
15-91-411	18:2042	OSTI; NTIS (US Sales Only); INIS		DE93606172	
17-91-159	18:1066	OSTI; NTIS (US Sales Only); INIS		DE93605325	
2-90-258	18:1005	OSTI; NTIS (US Sales Only); INIS		DE93605311	
2-90-550	18:1799	OSTI; NTIS (US Sales Only); INIS		DE93606033	
2-90-569	18:1913	OSTI; NTIS (US Sales Only); INIS		DE93606093	
2-90-570	18:1914	OSTI; NTIS (US Sales Only); INIS		DE93606094	
2-91-7	18:1884	OSTI; NTIS (US Sales Only); INIS		DE93606071	
2-91-11	18:1885	OSTI; NTIS (US Sales Only); INIS		DE93606083	
2-91-133	18:1800	OSTI; NTIS (US Sales Only); INIS		DE93606034	
2-91-137	18:1006	OSTI; NTIS (US Sales Only); INIS		DE93605264	
2-91-312	18:1801	OSTI; NTIS (US Sales Only); INIS		DE93606035	
2-91-316	18:1886	OSTI; NTIS (US Sales Only); INIS		DE93606084	
2-91-326	18:1887	OSTI; NTIS (US Sales Only); INIS		DE93606085	
2-91-328	18:1888	OSTI; NTIS (US Sales Only); INIS		DE93606086	
2-91-358	18:1942	OSTI; NTIS (US Sales Only); INIS		DE93606119	
2-91-359	18:1943	OSTI; NTIS (US Sales Only); INIS		DE93606120	
2-91-360	18:1944	OSTI; NTIS (US Sales Only); INIS		DE93606115	
2-91-393	18:1916	OSTI; NTIS (US Sales Only); INIS		DE93606095	
2-91-405	18:1945	OSTI; NTIS (US Sales Only); INIS		DE93606124	
2-91-437	18:1889	OSTI; NTIS (US Sales Only); INIS		DE93606068	

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2-91-445	18:1890	OSTI; NTIS (US Sales Only); INIS		DE93606069	
2-91-448	18:1891	OSTI; NTIS (US Sales Only); INIS		DE93606070	
2-91-449	18:1892	OSTI; NTIS (US Sales Only); INIS		DE93606087	
2-91-451	18:1946	OSTI; NTIS (US Sales Only); INIS		DE93606117	
2-91-462	18:1802	OSTI; NTIS (US Sales Only); INIS		DE93606036	
2-91-465	18:1947	OSTI; NTIS (US Sales Only); INIS		DE93606112	
2-91-475	18:1948	OSTI; NTIS (US Sales Only); INIS		DE93606125	
2-91-477	18:1803	OSTI; NTIS (US Sales Only); INIS		DE93606037	
2-91-517	18:1917	OSTI; NTIS (US Sales Only); INIS		DE93606096	
2-91-95	18:1915	OSTI; NTIS (US Sales Only); INIS		DE93606105	
3-90-293	18:2158	OSTI; NTIS (US Sales Only); INIS		DE93606304	
3-91-330	18:2222	OSTI; NTIS (US Sales Only); INIS		DE93606390	
3-91-428	18:2021	OSTI; NTIS (US Sales Only); INIS		DE93606156	
4-91-336	18:2041	OSTI; NTIS (US Sales Only); INIS		DE93606161	
5-90-578	18:1893	OSTI; NTIS (US Sales Only); INIS		DE93606088	
5-91-385	18:1804	OSTI; NTIS (US Sales Only); INIS		DE93606038	
5-91-401	18:2465	OSTI; NTIS (US Sales Only); INIS		DE93606014	
5-91-402	18:1894	OSTI; NTIS (US Sales Only); INIS		DE93606089	
5-91-485	18:1805	OSTI; NTIS (US Sales Only); INIS		DE93606039	
7-91-365	18:1949	OSTI; NTIS (US Sales Only); INIS		DE93606121	
JINR-R–					
1-90-584	18:2043	OSTI; NTIS (US Sales Only); INIS		DE93606171	
1-91-42	18:1421	OSTI; NTIS (US Sales Only); INIS		DE93605863	
1-91-439	18:2045	OSTI; NTIS (US Sales Only); INIS		DE93606165	
1-91-522	18:2046	OSTI; NTIS (US Sales Only); INIS		DE93606166	
1-91-85	18:2044	OSTI; NTIS (US Sales Only); INIS		DE93606173	
10-90-553	18:1423	OSTI; NTIS (US Sales Only); INIS		DE93605864	
10-91-147	18:1424	OSTI; NTIS (US Sales Only); INIS		DE93605847	
10-91-35	18:1372	OSTI; NTIS (US Sales Only); INIS		DE93605723	
10-91-444	18:1425	OSTI; NTIS (US Sales Only); INIS		DE93605865	
10-91-463	18:1426	OSTI; NTIS (US Sales Only); INIS		DE93605848	
11-91-327	18:2467	OSTI; NTIS (US Sales Only); INIS		DE93606011	
11-91-351	18:2003	OSTI; NTIS (US Sales Only); INIS		DE93606150	
11-91-371	18:1114	OSTI; NTIS (US Sales Only); INIS		DE93605379	
12-91-433	18:1450	OSTI; NTIS (US Sales Only); INIS		DE93605910	
13-90-452	18:1427	OSTI; NTIS (US Sales Only); INIS		DE93605866	
13-90-532	18:1373	OSTI; NTIS (US Sales Only); INIS		DE93605714	
13-90-580	18:1374	OSTI; NTIS (US Sales Only); INIS		DE93605724	
13-91-158	18:2187	OSTI; NTIS (US Sales Only); INIS		DE93606329	
13-91-313	18:2188	OSTI; NTIS (US Sales Only); INIS		DE93606330	
14-90-352	18:2189	OSTI; NTIS (US Sales Only); INIS		DE93606331	
14-91-208	18:2225	OSTI; NTIS (US Sales Only); INIS		DE93606391	
14-91-94	18:2161	OSTI; NTIS (US Sales Only); INIS		DE93606305	
17-91-446	18:1810	OSTI; NTIS (US Sales Only); INIS		DE93606040	
2-90-529	18:2071	OSTI; NTIS (US Sales Only); INIS		DE93606188	
2-91-3	18:2072	OSTI; NTIS (US Sales Only); INIS		DE93606189	
2-91-242	18:1007	OSTI; NTIS (US Sales Only); INIS		DE93605312	
2-91-315	18:1896	OSTI; NTIS (US Sales Only); INIS		DE93606090	
2-91-322	18:1918	OSTI; NTIS (US Sales Only); INIS		DE93606100	
2-91-333	18:2186	OSTI; NTIS (US Sales Only); INIS		DE93606332	
2-91-348	18:2002	OSTI; NTIS (US Sales Only); INIS		DE93606151	
2-91-403	18:1806	OSTI; NTIS (US Sales Only); INIS		DE93606041	
2-91-422	18:588	OSTI; NTIS (US Sales Only); INIS		DE93605760	
2-91-460	18:1807	OSTI; NTIS (US Sales Only); INIS		DE93606042	
3-91-172	18:1422	OSTI; NTIS (US Sales Only); INIS		DE93605849	
3-91-320	18:2062	OSTI; NTIS (US Sales Only); INIS		DE93606180	
3-91-392	18:2160	OSTI; NTIS (US Sales Only); INIS		DE93606306	
4-91-129	18:2083	OSTI; NTIS (US Sales Only); INIS		DE93606205	
4-91-142	18:2224	OSTI; NTIS (US Sales Only); INIS		DE93606392	
4-91-440	18:1808	OSTI; NTIS (US Sales Only); INIS		DE93606043	
4-91-447	18:1919	OSTI; NTIS (US Sales Only); INIS		DE93606097	
4-91-453	18:1809	OSTI; NTIS (US Sales Only); INIS		DE93606044	
6-91-430	18:2047	OSTI; NTIS (US Sales Only); INIS		DE93606164	
7-91-29	18:1449	OSTI; NTIS (US Sales Only); INIS		DE93605911	
9-90-547	18:1369	OSTI; NTIS (US Sales Only); INIS		DE93605725	
9-90-574	18:1370	OSTI; NTIS (US Sales Only); INIS		DE93605715	
9-91-31	18:1371	OSTI; NTIS (US Sales Only); INIS		DE93605708	
9-91-476	18:1319	OSTI; NTIS (US Sales Only); INIS		DE93605695	
9-91-494	18:1320	OSTI; NTIS (US Sales Only); INIS		DE93605696	
9-91-55	18:1318	OSTI; NTIS (US Sales Only); INIS		DE93605697	

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
Juel–					
2585	18:493	OSTI; NTIS (US Sales Only); INIS		DE93720185	
2593	18:929	OSTI; NTIS (US Sales Only)		DE93720186	
2606	18:1115	OSTI; NTIS (US Sales Only)		DE93720396	
2612	18:1067	OSTI; NTIS (US Sales Only); INIS		DE93720326	
KAERI/RR–					
1001/90	18:589	OSTI; NTIS (US Sales Only); INIS		DE93605761	
1002/90	18:514	OSTI; NTIS (US Sales Only); INIS		DE93605812	
1003/90	18:546	OSTI; NTIS (US Sales Only); INIS		DE93605745	
1004/90	18:590	OSTI; NTIS (US Sales Only); INIS		DE93605762	
1007/91	18:157	OSTI; NTIS (US Sales Only); INIS		DE93605650	
1009/90	18:607	OSTI; NTIS (US Sales Only); INIS		DE93605768	
1013/91	18:484	OSTI; NTIS (US Sales Only); INIS		DE93605782	
1014/91	18:245	OSTI; NTIS (US Sales Only); INIS		DE93605924	
1017/90	18:703	OSTI; NTIS (US Sales Only); INIS		DE93605833	
1018/90	18:1720	OSTI; NTIS (US Sales Only); INIS		DE93605571	
1020/90	18:2226	OSTI; NTIS (US Sales Only); INIS		DE93606393	
1023/90	18:485	OSTI; NTIS (US Sales Only); INIS		DE93605783	
1028/91	18:515	OSTI; NTIS (US Sales Only); INIS		DE93605813	
1029/91	18:1196	OSTI; NTIS (US Sales Only); INIS		DE93605215	
1030/91	18:486	OSTI; NTIS (US Sales Only); INIS		DE93605784	
1042/91	18:1571	OSTI; NTIS (US Sales Only); INIS		DE93605426	
1043/91	18:2077	OSTI; NTIS (US Sales Only); INIS		DE93606193	
1044/91	18:2227	OSTI; NTIS (US Sales Only); INIS		DE93606394	
1045/91	18:1755	OSTI; NTIS (US Sales Only); INIS		DE93605553	
1046/91	18:1253	OSTI; NTIS (US Sales Only); INIS		DE93605663	
1047/91	18:442	OSTI; NTIS (US Sales Only); INIS		DE93605773	
1048/91	18:578	OSTI; NTIS (US Sales Only); INIS		DE93605749	
1051/91	18:780	OSTI; NTIS (US Sales Only); INIS		DE93605590	
1053/91	18:579	OSTI; NTIS (US Sales Only); INIS		DE93605750	
1054/91	18:246	OSTI; NTIS (US Sales Only); INIS		DE93605917	
1055/91	18:1764	OSTI; NTIS (US Sales Only); INIS		DE93605445	
1056/91	18:174	OSTI; NTIS (US Sales Only); INIS		DE93605763	
1057/91	18:543	OSTI; NTIS (US Sales Only); INIS		DE93605954	
1062/91	18:1254	OSTI; NTIS (US Sales Only); INIS		DE93605664	
1063/91	18:487	OSTI; NTIS (US Sales Only); INIS		DE93605785	
1065/91	18:1721	OSTI; NTIS (US Sales Only); INIS		DE93605569	
1067/91	18:1264	OSTI; NTIS (US Sales Only); INIS		DE93605736	
1068/91	18:716	OSTI; NTIS (US Sales Only); INIS		DE93605591	
1069/91	18:488	OSTI; NTIS (US Sales Only); INIS		DE93605446	
1070/91	18:1756	OSTI; NTIS (US Sales Only); INIS		DE93605611	
1071/91	18:552	OSTI; NTIS (US Sales Only); INIS		DE93605748	
1073/91	18:1170	OSTI; NTIS (US Sales Only); INIS		DE93605210	
1074/91	18:1296	OSTI; NTIS (US Sales Only); INIS		DE93605685	
1075/91	18:2407	OSTI; NTIS (US Sales Only); INIS		DE93606019	
1076/91	18:1008	OSTI; NTIS (US Sales Only); INIS		DE93605304	
1079/91	18:1009	OSTI; NTIS (US Sales Only); INIS		DE93605265	
1080/91	18:580	OSTI; NTIS (US Sales Only); INIS		DE93605751	
1081/91	18:1287	OSTI; NTIS (US Sales Only); INIS		DE93605683	
1082/91	18:581	OSTI; NTIS (US Sales Only); INIS		DE93605752	
1083/91	18:2493	OSTI; NTIS (US Sales Only); INIS		DE93605964	
1091/91	18:1197	OSTI; NTIS (US Sales Only); INIS		DE93605221	
1095/91	18:303	OSTI; NTIS (US Sales Only); INIS		DE93606010	
1096/91	18:1068	OSTI; NTIS (US Sales Only); INIS		DE93605320	
1097/91	18:1722	OSTI; NTIS (US Sales Only); INIS		DE93605572	
1099/91	18:1723	OSTI; NTIS (US Sales Only); INIS		DE93605567	
1102/91	18:1198	OSTI; NTIS (US Sales Only); INIS		DE93605222	
994/91	18:483	OSTI; NTIS (US Sales Only); INIS		DE93605786	
995/91	18:545	OSTI; NTIS (US Sales Only); INIS		DE93605746	
996/90	18:308	OSTI; NTIS (US Sales Only); INIS		DE93605223	
998/90	18:1754	OSTI; NTIS (US Sales Only); INIS		DE93605612	
999/91	18:1139	OSTI; NTIS (US Sales Only); INIS		DE93605123	
KCP–					
613-4831	18:888	OSTI; NTIS; GPO Dep.	E 1.99:	DE93001257	PC-702
613-4841	18:1140	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000399	MF-706
KFK–					
5010	18:1255	OSTI; NTIS (US Sales Only); INIS		DE93720172	
5031	18:2398	OSTI; NTIS (US Sales Only); INIS		DE93720183	
5040	18:1765	OSTI; NTIS (US Sales Only); INIS		DE93720184	
5047	18:2399	OSTI; NTIS (US Sales Only); INIS		DE93720174	

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KFK-PEF–					
90	18:1766	OSTI; NTIS (US Sales Only)		DE93720218	
KFK-PWAB–					
9	18:1640	OSTI; NTIS (US Sales Only)		DE93720173	
KTM/E-B–					
101	18:247	OSTI; NTIS; INIS		DE93604008	
110	18:749	OSTI; NTIS		DE93721597	
112	18:358	OSTI; NTIS		DE93721595	
113	18:359	OSTI; NTIS		DE93721596	
114	18:1497	OSTI; NTIS		DE93721610	
KTM/E-C–					
26	18:2408	OSTI; NTIS; INIS		DE93606020	
LA–					
12206	18:1572	OSTI; NTIS; GPO Dep.	E 1.99:	DE93002118	PC-908
12235-MS	18:1462	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93002714	PC-705; PC-741
12335-MS	18:1573	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92040619	MF-940; MF-903
12353-MS	18:2468	OSTI; NTIS; GPO Dep.	E 1.99:	DE93001428	
12379-MS	18:1428	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000355	MF-706
12382-MS	18:397	OSTI; NTIS; GPO Dep.	E 1.99:	DE93001360	MF-903
12387-M	18:304	OSTI; NTIS; GPO Dep.	E 1.99:	DE93002849	MF-714
12388-M	18:305	OSTI; NTIS; GPO Dep.	E 1.99:	DE93002308	MF-714
12412-MS	18:1429	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000505	MF-700
LA-UR–					
92-1753	18:2469	OSTI; NTIS; GPO Dep.	E 1.99:	DE92017412	MF-905
92-1981	18:1214	OSTI; NTIS; GPO Dep.	E 1.99:	DE92017506	MF-706
92-1982	18:1010	OSTI; NTIS; GPO Dep.	E 1.99:	DE92017452	MF-706
92-2338	18:2470	OSTI; NTIS; GPO Dep.	E 1.99:	DE92018917	
92-2768	18:1323	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000790	MF-414
92-2816	18:1376	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000789	MF-414
92-2904	18:2384	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000794	MF-424
92-2946	18:1831	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000795	MF-910
92-2961	18:1215	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000689	MF-722
92-2968	18:1297	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000688	MF-906; MF-910
92-2993	18:2385	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000686	MF-424
92-2998	18:1377	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000685	MF-910; MF-906
92-3003	18:1069	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93000683	
92-3017	18:1378	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000681	MF-700
92-3022	18:1070	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000680	MF-406
92-3046	18:2088	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000657	MF-414
92-3055	18:2228	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000654	MF-406
92-3061	18:1356	*See* EGG–10617-5116			
92-3069	18:1071	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000651	MF-404
92-3074	18:1216	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000858	MF-906
92-3086	18:1072	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000855	MF-406
92-3126	18:2190	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000854	MF-410; MF-405
92-3130	18:1011	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000853	MF-401; MF-404
92-3150	18:1430	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000700	MF-405; MF-414
92-3161	18:2386	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000699	MF-904
92-3164	18:2387	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000698	MF-712
92-3165	18:1379	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000697	MF-414
92-3171	18:1456	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000873	MF-904; MF-902
92-3182	18:1217	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000871	MF-706
92-3188	18:1073	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000870	MF-404
92-3192	18:1975	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000867	MF-414
92-3194	18:1976	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000866	MF-410
92-3199	18:2004	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000865	MF-413
92-3203	18:1380	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000863	MF-414; MF-406
92-3208	18:1977	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000862	MF-410
92-3215	18:1298	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000875	MF-910
LAL–					
92-11	18:1375	OSTI; NTIS (US Sales Only); INIS		DE93720938	
92-20	18:1321	OSTI; NTIS (US Sales Only); INIS		DE93721027	

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92-21	18:1950	OSTI; NTIS (US Sales Only); INIS		DE93721028	
92-23	18:1972	OSTI; NTIS (US Sales Only); INIS		DE93721703	
92-26	18:1951	OSTI; NTIS (US Sales Only); INIS		DE93721704	
92-27	18:1973	OSTI; NTIS (US Sales Only); INIS		DE93721705	
LAL-RA–					
90-91	18:1840	OSTI; NTIS (US Sales Only); INIS		DE93721001	
LAL-RT–					
92-09	18:1322	OSTI; NTIS (US Sales Only); INIS		DE93721702	
LAPP-T–					
90-04	18:1974	OSTI; NTIS (US Sales Only); INIS		DE93721024	
LBL–					
29752	18:845	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000636	MF-350
30340	18:2388	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92041189	MF-426
30451	18:1381	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92041167	
30937	18:1012	OSTI; NTIS; GPO Dep.	E 1.99:	DE92041163	MF-401
31562	18:846	OSTI; NTIS; GPO Dep.	E 1.99:	DE93001569	MF-400
31565	18:1832	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92041186	MF-414
31675	18:1171	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000571	MF-404
31848	18:1324	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000565	MF-414
31855	18:1989	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93001537	MF-413
31916	18:1498	OSTI; NTIS; GPO Dep.	E 1.99:	DE93001581	MF-350
32038	18:2389	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000568	MF-406
32063	18:360	OSTI; NTIS; GPO Dep.	E 1.99:	DE93001536	
32091	18:847	OSTI; NTIS; GPO Dep.	E 1.99:	DE93001468	MF-350
32095	18:1013	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92041208	MF-404
32139	18:395	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000628	MF-250
32179	18:1757	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000578	MF-402; MF-407
32195	18:1778	OSTI; NTIS; GPO Dep.	E 1.99:	DE93001520	MF-250
32214	18:783	OSTI; NTIS; GPO Dep.	E 1.99:	DE92041188	MF-350
32222-Exc.	18:1325	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92041169	MF-414
32250	18:1299	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000579	MF-414
32257	18:848	OSTI; NTIS; GPO Dep.	E 1.99:	DE92041177	MF-350
32258	18:1074	OSTI; NTIS; GPO Dep.	E 1.99:	DE92041165	MF-401
32279	18:2097	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000635	MF-405
32290	18:1014	OSTI; NTIS; GPO Dep.	E 1.99:	DE92041212	MF-404
32347	18:1431	OSTI; NTIS; GPO Dep.	E 1.99:	DE92041203	MF-606
32357	18:404	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000630	MF-251
32384	18:871	OSTI; NTIS; GPO Dep.	E 1.99:	DE92041166	
32385	18:775	OSTI; NTIS; GPO Dep.	E 1.99:	DE93001598	
32388	18:1116	OSTI; NTIS; GPO Dep.	E 1.99:	DE92041209	MF-404
32390	18:1015	OSTI; NTIS; GPO Dep.	E 1.99:	DE92041206	MF-404
32395	18:741	OSTI; NTIS; GPO Dep.	E 1.99:	DE92041180	MF-331
32400	18:1016	OSTI; NTIS; GPO Dep.	E 1.99:	DE92041216	MF-404
32430	18:1141	OSTI; NTIS; GPO Dep.	E 1.99:	DE92041201	MF-401
32446	18:1382	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92041211	MF-414
32452-Abst.	18:1383	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92041190	MF-414
32463	18:1384	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000575	MF-414
32468	18:1385	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92041171	MF-414
32473	18:1173	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92041214	MF-401
32483	18:1017	OSTI; NTIS; GPO Dep.	E 1.99:	DE92041213	MF-404
32497	18:2005	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92041187	MF-413
32500	18:1451	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000627	MF-414
32510	18:1075	OSTI; NTIS; GPO Dep.	E 1.99:	DE92041196	MF-404
32512	18:2471	OSTI; NTIS; GPO Dep.	E 1.99:	DE92041210	MF-404
32513	18:1076	OSTI; NTIS; GPO Dep.	E 1.99:	DE92041185	MF-404
32514	18:1978	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000569	MF-414
32515	18:2084	OSTI; NTIS; GPO Dep.	E 1.99:	DE92041173	MF-401
32516	18:1326	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92041168	MF-414
32526	18:1432	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92041179	MF-414
32537	18:1396	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93001571	PC-414
32538	18:742	OSTI; NTIS; GPO Dep.	E 1.99:	DE92041217	MF-335
32561	18:1327	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000573	MF-414
32562	18:1833	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000576	MF-413
32577	18:829	OSTI; NTIS; GPO Dep.	E 1.99:	DE92041204	MF-332
32580	18:1328	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92041205	MF-414
32581	18:1329	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92041191	MF-414
32634	18:1834	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92041164	MF-414
32642	18:1117	OSTI; NTIS; GPO Dep.	E 1.99:	DE92041195	MF-404
32680	18:1386	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000634	MF-413
32689	18:1077	OSTI; NTIS; GPO Dep.	E 1.99:	DE92041178	MF-404

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
32711	18:1018	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000570	MF-404
32715	18:1019	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000574	MF-404
32728	18:1181	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000580	MF-213
32734	18:1288	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000572	MF-404
LBL-PUB–					
3104	18:1300	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000629	MF-411
5330	18:784	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000577	MF-400
5347	18:1433	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92041174	MF-414
701	18:1663	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92041207	MF-408
LIU-TEK-LIC–					
91-48	18:1707	OSTI; NTIS; INIS		DE93603729	
LIYaF–					
1655	18:2006	OSTI; NTIS (US Sales Only); INIS		DE93606144	
LMU–					
09/92.	18:1958	*See* IC–92/196			
LPCC-T–					
92-01	18:2048	OSTI; NTIS (US Sales Only); INIS		DE93721016	
LU-TP–					
92-8	18:1920	OSTI; NTIS; INIS		DE93604290	
92-12	18:2049	OSTI; NTIS; INIS		DE93604504	
MAGNEC-C–					
91-01.	18:1567	*See* INFO–0378			
MHD-ITC–					
92-126	18:822	*See* DOE/PC/90274–T20			
92-168	18:821	*See* DOE/PC/90274–T19			
MT-CWJR–					
092-023	18:975	*See* DOE/ER/45308–6			
NDP–					
041	18:1501	*See* ORNL/CDIAC–53			
NEDO-ITE–					
9101	18:759	OSTI; NTIS		DE93723970	
9104	18:930	OSTI; NTIS		DE93723971	
9107	18:760	OSTI; NTIS		DE93723972	
9109	18:889	OSTI; NTIS		DE93723973	
NEDO-P–					
9101	18:803	OSTI; NTIS		DE93723959	
9102	18:804	OSTI; NTIS		DE93723960	
9103	18:805	OSTI; NTIS		DE93723961	
9107	18:781	OSTI; NTIS		DE93723962	
9111	18:331	OSTI; NTIS		DE93723963	
9112	18:95	OSTI; NTIS		DE93723964	
9113	18:69	OSTI; NTIS		DE93723965	
9114	18:357	OSTI; NTIS		DE93723966	
9115	18:54	OSTI; NTIS		DE93723967	
9118	18:830	OSTI; NTIS		DE93723968	
9122	18:788	OSTI; NTIS		DE93723969	
NEI-DK–					
946	18:849	OSTI; NTIS		DE93721435	
947	18:890	OSTI; NTIS		DE93721433	
948	18:850	OSTI; NTIS		DE93721434	
949	18:891	OSTI; NTIS		DE93721438	
950	18:370	OSTI; NTIS		DE93721437	
951	18:851	OSTI; NTIS		DE93721385	
952	18:383	OSTI; NTIS		DE93721384	
953	18:419	OSTI; NTIS		DE93721383	
954	18:1499	OSTI; NTIS		DE93721380	
955	18:371	OSTI; NTIS		DE93721382	
957	18:931	OSTI; NTIS		DE93721513	
958	18:936	OSTI; NTIS		DE93721409	
959	18:761	OSTI; NTIS		DE93721472	
960	18:937	OSTI; NTIS		DE93721468	
961	18:938	OSTI; NTIS		DE93721427	
962	18:324	OSTI; NTIS		DE93721422	
963	18:852	OSTI; NTIS		DE93721421	
964	18:853	OSTI; NTIS		DE93721420	
965	18:854	OSTI; NTIS		DE93721419	
966	18:1779	OSTI; NTIS		DE93721412	
967	18:1780	OSTI; NTIS		DE93721413	
968	18:806	OSTI; NTIS		DE93721411	
969	18:348	OSTI; NTIS		DE93721410	
971	18:807	OSTI; NTIS		DE93721467	

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
972	18:855	OSTI; NTIS		DE93721451	
973	18:856	OSTI; NTIS		DE93721455	
974	18:1770	OSTI; NTIS		DE93721449	
975	18:857	OSTI; NTIS		DE93721454	
977	18:99	OSTI; NTIS		DE93721456	
978	18:376	OSTI; NTIS		DE93721450	
979	18:351	OSTI; NTIS		DE93721403	
982	18:731	OSTI; NTIS		DE93721440	
990	18:325	OSTI; NTIS		DE93721417	
991	18:319	OSTI; NTIS		DE93721416	
992	18:320	OSTI; NTIS		DE93721415	
NEI-FI–					
168	18:406	OSTI; NTIS		DE93721624	
NEI-NO–					
265	18:117	OSTI; NTIS		DE93721652	
266	18:118	OSTI; NTIS		DE93721653	
267	18:119	OSTI; NTIS		DE93721654	
268	18:120	OSTI; NTIS		DE93721655	
269	18:121	OSTI; NTIS		DE93721656	
270	18:135	OSTI; NTIS; INIS; inis		DE93721657	
271	18:122	OSTI; NTIS		DE93721658	
272	18:123	OSTI; NTIS		DE93721659	
273	18:124	OSTI; NTIS		DE93721660	
274	18:125	OSTI; NTIS		DE93721661	
275	18:762	OSTI; NTIS		DE93721662	
276	18:763	OSTI; NTIS		DE93721663	
277	18:1268	OSTI; NTIS		DE93721627	
278	18:893	OSTI; NTIS		DE93721628	
279	18:109	OSTI; NTIS		DE93721629	
281	18:1256	OSTI; NTIS		DE93721637	
282	18:858	OSTI; NTIS		DE93721638	
283	18:772	OSTI; NTIS		DE93721639	
284	18:1275	OSTI; NTIS		DE93721664	
285	18:1257	OSTI; NTIS; INIS		DE93721665	
286	18:148	OSTI; NTIS		DE93721666	
287	18:145	OSTI; NTIS		DE93721667	
288	18:764	OSTI; NTIS; INIS		DE93721668	
289	18:765	OSTI; NTIS		DE93721669	
290	18:766	OSTI; NTIS		DE93721670	
291	18:752	OSTI; NTIS; INIS		DE93721671	
NEI-SE–					
98	18:2409	OSTI; NTIS; INIS		DE93604075	
NESC–					
1038	18:2430	*See* ESTSC–000509C007400			
179	18:2429	*See* ESTSC–000508U110000			
257	18:2439	*See* ESTSC–000521GE63500			
322	18:2433	*See* ESTSC–000512I036000			
333	18:2436	*See* ESTSC–000518U110800			
492	18:2445	*See* ESTSC–000528C660000			
532	18:2428	*See* ESTSC–000507C660000			
543	18:2438	*See* ESTSC–000520I036000			
565	18:2431	*See* ESTSC–000510I036000			
617	18:2432	*See* ESTSC–000511I036000			
634	18:2440	*See* ESTSC–000522I036000			
634	18:2441	*See* ESTSC–000522MNFRM00			
933	18:2446	*See* ESTSC–000531C760000			
9405	18:2444	*See* ESTSC–000525IBMPC00			
9429	18:2450	*See* ESTSC–000534MNFRM00			
9522	18:2435	*See* ESTSC–000517D078000			
9580	18:2437	*See* ESTSC–000519IPCAT00			
9667	18:2442	*See* ESTSC–000523C760000			
9668	18:2443	*See* ESTSC–000524D078000			
9820	18:2451	*See* ESTSC/NRC–000092I303300			
9853	18:2434	*See* ESTSC–000516C017600			
NEA0329	18:2447	*See* ESTSC–000533C018000			
NEA0329	18:2448	*See* ESTSC–000533DVX1100			
NEA0329	18:2449	*See* ESTSC–000533I309000			
NIIEFA-P-D–					
0826	18:2191	OSTI; NTIS (US Sales Only); INIS		DE93606333	
NIKHEF-H/K–					
92-01	18:1921	OSTI; NTIS; INIS		DE93604291	

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NIKHEF-K-EMIN–					
92-01	18:1434	OSTI; NTIS; INIS		DE93603917	
NINA-R–					
029	18:767	OSTI; NTIS		DE93721672	
NIPER–					
596	18:2472	OSTI; NTIS; GPO Dep.	E 1.99:	DE92001071	PC-122
613	18:110	OSTI; NTIS; GPO Dep.	E 1.99:	DE93001397	MF-122
621-Vol.1	18:138	OSTI; NTIS; GPO Dep.	E 1.99:	DE92041200	MF-122
NIST/SP–					
500-204	18:722	*See* NUREG/CR–5930			
NISTIR–					
4811	18:943	*See* ORNL/Sub–83-21322/02			
NKS–					
91-8	18:1758	OSTI; NTIS; INIS		DE93603683	
NKS-RAD–					
2-91-2	18:1641	OSTI; NTIS; INIS		DE93605435	
NORD–					
91-53	18:791	OSTI; NTIS		DE93711221	
NREL/TP–					
451-5094	18:372	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000022	MF-273
NRL/MR–					
4790-92-7112	18:2390	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000881	MF-712
NSF-ITP–					
92-19	18:1818	*See* DOE/ER/40682–18			
92-93	18:1848	*See* DOE/ER/40682–11			
NSS/R–					
128	18:248	OSTI; NTIS (US Sales Only); INIS		DE93605943	
258	18:249	OSTI; NTIS (US Sales Only); INIS		DE93605944	
260	18:250	OSTI; NTIS (US Sales Only); INIS		DE93605945	
NUREG–					
0837-Vol.12-No.2	18:611	OSTI; NTIS; INIS; GPO		TI92041076	
1242-Vol.2-Pt.1	18:540	OSTI; NTIS; INIS; GPO		TI92040780	
NUREG/CP–					
0122-Vol.1	18:717	OSTI; NTIS; INIS; GPO		TI92041279	
0122-Vol.2	18:582	OSTI; NTIS; INIS; GPO		TI92041278	
NUREG/CR–					
2907-Vol.10	18:612	OSTI; NTIS; INIS; GPO		TI93000761	
4674-Vol.15	18:718	OSTI; NTIS; INIS; GPO		TI93000832	
5121	18:583	OSTI; NTIS; INIS; GPO		TI92011866	
5416	18:584	OSTI; NTIS; INIS; GPO		TI93001339	
5787-Vol.1	18:719	OSTI; NTIS; INIS; GPO		TI93000583	
5787-Vol.2	18:720	OSTI; NTIS; INIS; GPO		TI93000584	
5910	18:721	OSTI; NTIS; INIS; GPO		TI92040802	
5930	18:722	OSTI; NTIS; INIS; GPO		TI93000626	
6003	18:461	OSTI; NTIS; INIS; GPO		TI93000882	
NUTEK-NYEL–					
92-2	18:536	OSTI; NTIS; INIS		DE93603792	
ORNL–					
6638	18:1574	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000503	MF-902
ORNL/ATD–					
64	18:1265	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000427	MF-406
ORNL/CDIAC–					
48	18:1500	OSTI; NTIS; GPO Dep.	E 1.99:	DE92041010	MF-402
53	18:1501	OSTI; NTIS; GPO Dep.	E 1.99:	DE92040521	MF-402
ORNL/ER–					
122	18:251	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92040848	MF-902
58-D1	18:225	*See* DOE/ER–1070-D1			
90	18:1575	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93001297	MF-902
ORNL/FMP–					
92/1	18:51	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000504	MF-114
ORNL/NOAC–					
232-Vol.15	18:718	*See* NUREG/CR–4674-Vol.15			
ORNL/NSP–					
92/1	18:723	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000546	MF-500
ORNL/RAP/Sub–					
86-72139/2	18:252	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000502	MF-402
ORNL/RASA–					
91/19	18:1576	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92041368	MF-902
91/22	18:1577	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000556	MF-902
91/25	18:1578	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000550	MF-902
91/26	18:1579	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000555	MF-902

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ORNL/RASA–					
91/27	18:1580	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000552	MF-902
92/3	18:1581	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000551	MF-902
ORNL/RE–					
25-No.1	18:1675	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000457	MF-600
ORNL/Sub–					
83-21322/02	18:943	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000834	MF-114
85-55901/03	18:1118	OSTI; NTIS; GPO Dep.	E 1.99:	DE93001615	MF-114
ORNL/TM–					
10767	18:608	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92040618	MF-541
11917	18:1467	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92041388	
11918	18:1468	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93000976	
11973	18:1461	OSTI; NTIS; GPO Dep.	E 1.99:	DE93001882	MF-700
12045	18:2473	OSTI; NTIS; GPO Dep.	E 1.99:	DE93002354	MF-405
12125	18:2474	OSTI; NTIS; GPO Dep.	E 1.99:	DE93002355	MF-405
12130	18:461	*See* NUREG/CR–6003			
12163	18:1218	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000835	
12165	18:1219	OSTI; NTIS; GPO Dep.	E 1.99:	DE93002735	MF-406
12188	18:878	OSTI; NTIS; GPO Dep.	E 1.99:	DE93001523	
OUP–					
92-17	18:373	OSTI; NTIS		DE93721642	
OY/PSTL-TIED–					
79	18:79	OSTI; NTIS		DE93721622	
81	18:361	OSTI; NTIS; INIS		DE93721626	
PATENTS–					
	18:111	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN			
	18:115	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN			
	18:137	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN			
	18:153	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN			
	18:154	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN			
	18:352	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN			
	18:362	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN			
	18:363	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN			
	18:389	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN			
	18:868	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN			
	18:897	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN			
	18:898	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN			

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	18:939	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN			
	18:944	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN			
	18:1267	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN			
	18:1269	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN			
	18:1283	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN			
	18:1284	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $6.00 CAN; MF $4.00 CAN			
PCCF-RI–					
92-01	18:1142	OSTI; NTIS (US Sales Only); INIS		DE93721055	
92-04	18:1979	OSTI; NTIS (US Sales Only); INIS		DE93721706	
92-05	18:1980	OSTI; NTIS (US Sales Only); INIS		DE93721026	
92-07	18:1952	OSTI; NTIS (US Sales Only); INIS		DE93721002	
PCCF-T–					
91-01	18:1953	OSTI; NTIS (US Sales Only); INIS		DE93721004	
91-02	18:2050	OSTI; NTIS (US Sales Only); INIS		DE93721005	
91-03	18:1143	OSTI; NTIS (US Sales Only); INIS		DE93721054	
92-01	18:1724	OSTI; NTIS (US Sales Only); INIS		DE93721006	
92-02	18:2051	OSTI; NTIS (US Sales Only); INIS		DE93721007	
PNL–					
7877-Rev.1	18:1759	OSTI; NTIS (documentation only); ESTSC (complete software package), P.O. Box 1020, Oak Ridge, TN 37831-1020; GPO Dep.	E 1.99:	DE93002438	MF-407
8047	18:253	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93001271	MF-940
8048	18:254	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93001272	MF-940
8143	18:1582	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93001344	MF-600
8164	18:894	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000839	MF-310
8225	18:785	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000838	MF-310
8330	18:1220	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000841	MF-600
8336	18:786	OSTI; NTIS; GPO Dep.	E 1.99:	DE93002180	MF-350
8338	18:255	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93001658	MF-940
PNL-SA–					
18921	18:724	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93001311	MF-520
20025	18:377	OSTI; NTIS; GPO Dep.	E 1.99:	DE93001301	MF-406
20288	18:859	OSTI; NTIS; GPO Dep.	E 1.99:	DE92041329	MF-500
20520	18:256	OSTI; NTIS; GPO Dep.	E 1.99:	DE92041334	MF-506
20523	18:537	OSTI; NTIS; GPO Dep.	E 1.99:	DE93001309	MF-900
20751	18:1221	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000850	
20796	18:739	OSTI; NTIS; GPO Dep.	E 1.99:	DE92041333	MF-202
20804	18:860	OSTI; NTIS; GPO Dep.	E 1.99:	DE93001314	MF-350
20909	18:861	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92041341	MF-350
20941	18:257	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92041328	MF-940
20951	18:1502	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92041339	MF-402; MF-405
20976	18:862	OSTI; NTIS; GPO Dep.	E 1.99:	DE92041336	MF-350
21009	18:258	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93001516	MF-902
21019	18:863	OSTI; NTIS; GPO Dep.	E 1.99:	DE92041337	MF-350
21032	18:740	OSTI; NTIS; GPO Dep.	E 1.99:	DE92041330	MF-350
21233	18:259	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92041332	MF-940
21261	18:1174	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92041342	MF-501
PNWD–					
2017-HEDR	18:613	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000483	MF-707
PPPL–					
2858	18:2344	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93002632	PC-426

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2860	18:2345	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93002631	PC-420; PC-426; PC-427
2861	18:2346	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93002630	PC-426
PPPL-TH–					
92-1	18:2347	OSTI; NTIS; GPO Dep.	E 1.99:	DE93002629	PC-420; PC-427
PR-CMa–					
69.	18:2400	*See* AECL–9108			
PSI–					
1024/TR-1206	18:61	*See* DOE/PC/90751–T14			
PU-NE–					
92/2	18:501	*See* DOE/ER/13045–T1			
RAL–					
92-021	18:1954	OSTI; NTIS (US Sales Only); INIS		DE93604340	
92-022	18:1981	OSTI; NTIS (US Sales Only); INIS		DE93606140	
92-030	18:1922	OSTI; NTIS (US Sales Only); INIS		DE93604260	
92-031	18:1435	OSTI; NTIS (US Sales Only); INIS		DE93603984	
92-032	18:1436	OSTI; NTIS (US Sales Only); INIS		DE93603985	
92-035	18:1923	OSTI; NTIS (US Sales Only); INIS		DE93606098	
92-037	18:1955	OSTI; NTIS (US Sales Only); INIS		DE93606113	
RF–					
9/91	18:126	OSTI; NTIS		DE93721643	
RFP–					
4485	18:260	OSTI; NTIS; GPO Dep.	E 1.99:	DE93001883	PC-706
4553	18:1642	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92040779	MF-702
RTR–					
328	18:617	*See* DPSP–61-1841			
708	18:619	*See* DPSP–64-2079			
85	18:616	*See* DPSP–58-814			
SA-FOU–					
91-01	18:1266	OSTI; NTIS; INIS		DE93603790	
SA-PUB–					
9/89-Vol.1	18:1504	OSTI; NTIS; INIS		DE93721620	
9/89-Vol.2	18:1527	OSTI; NTIS		DE93721621	
SAND–					
88-0906	18:583	*See* NUREG/CR–5121			
91-2255C	18:1222	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92040976	MF-810
91-2416	18:261	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93001349	MF-814
91-2602C	18:1223	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000720	MF-940
91-2603C	18:1760	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000758	MF-902
91-2666C	18:1224	OSTI; NTIS; GPO Dep.	E 1.99:	DE92041161	MF-904
91-2669C	18:1225	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000744	MF-722
91-2687C	18:1226	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92041147	MF-906
91-2722C	18:1463	OSTI; NTIS; GPO Dep.	E 1.99:	DE92040097	MF-706
91-2871C	18:1457	OSTI; NTIS; GPO Dep.	E 1.99:	DE92040259	MF-706
91-7071	18:262	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93001801	MF-721
91-7099	18:263	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93001802	MF-721
92-0392C	18:1119	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000755	MF-404
92-0462C	18:1276	OSTI; NTIS; GPO Dep.	E 1.99:	DE92040960	MF-706
92-0508	18:2475	OSTI; NTIS; GPO Dep.	E 1.99:	DE93002597	MF-405
92-0650C	18:1277	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000748	MF-706
92-0651C	18:1458	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000750	MF-706
92-0684C	18:300	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92040264	MF-722
92-0685C	18:264	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92040268	MF-940
92-0694	18:1258	OSTI; NTIS; GPO Dep.	E 1.99:	DE93002738	MF-405
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92-1011	18:1466	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000843	MF-706
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92-1813C	18:1120	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000709	MF-704
92-1820C	18:538	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000754	MF-743
92-1872C	18:2479	OSTI; NTIS; GPO Dep.	E 1.99:	DE92040967	MF-905
92-1877C	18:1280	OSTI; NTIS; GPO Dep.	E 1.99:	DE92040975	MF-706
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92-2049C	18:539	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000752	MF-743
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